SCIENTIFIC AMERICAN

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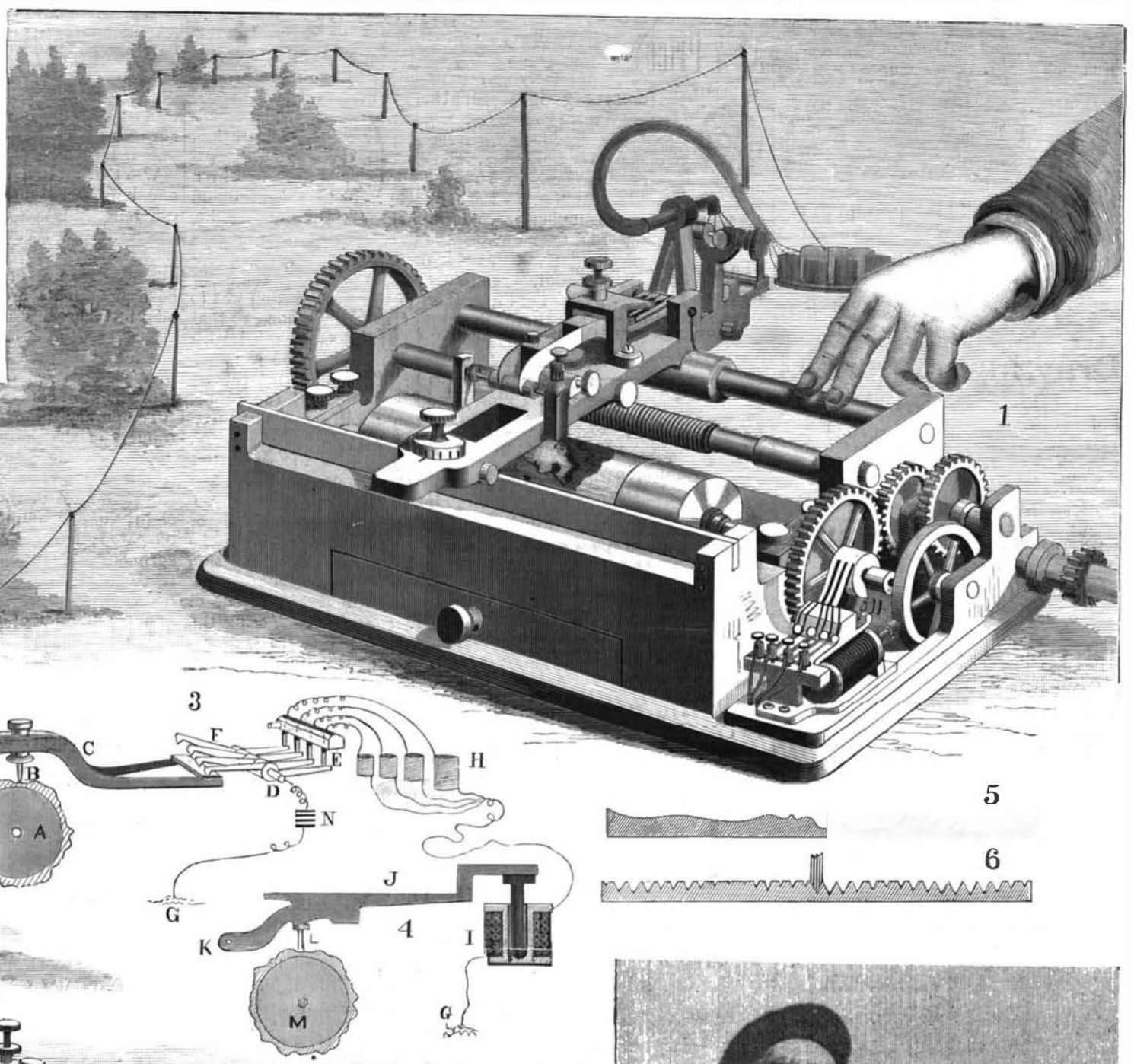

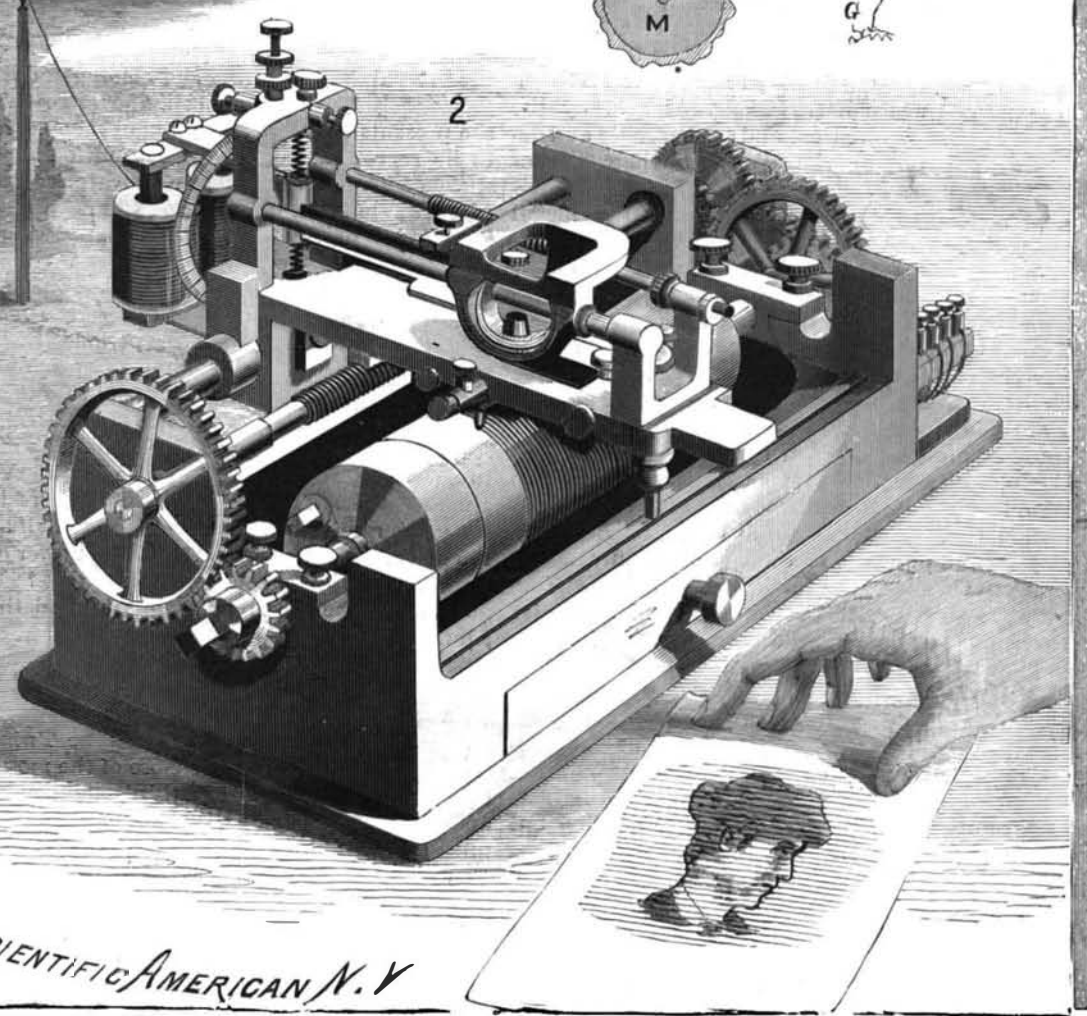

1. The transmitter. 2. The receiver. 3. Diagram of transmitter. 4. Diagram of receiver. 5. Section of film. 6. Section of lined film. The portrait at the upper corner is that of the inventor and is printed from an electro of the picture made by the apparatus. The engraving at the right is another picture printed from an electro of the picture made by the apparatus.

THE AMSTUTZ ELECTRO-ARTOGRAPH.—[See page 215.]

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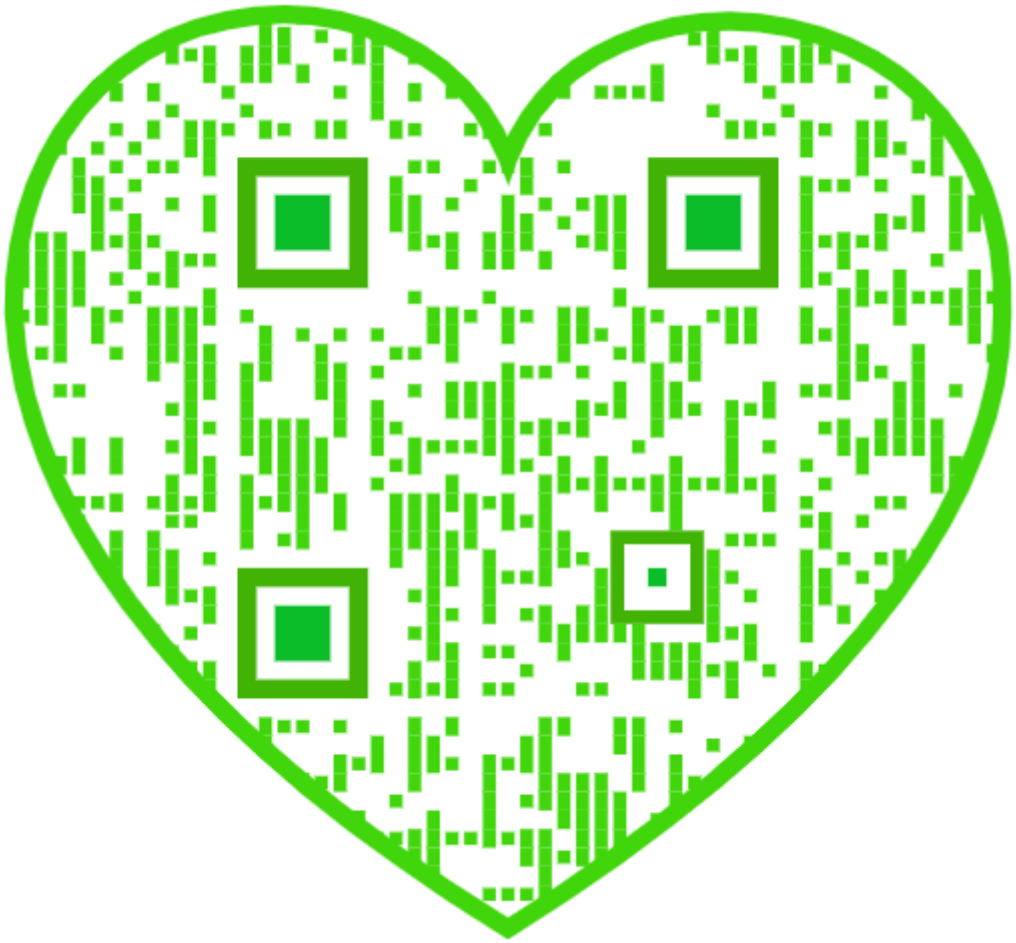

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PATENT TRUSTS.

A decision of unusual interest and possible importance has recently been made by Judge Baker, of the United States Court for the District of Indiana. If upheld by the Supreme Court, it is likely nullify, to a great extent, the existing laws relating to patents.

By the eighth section of the Constitution, Congress is empowered "To promote the progress of science and the useful arts, by securing for limited times, to authors and inventors, the exclusive right to their respective writings and discoveries."

Here is a clear and express provision by which a special class of trusts or monopolies may be set up, which are to be exercised and enjoyed by the individuals to whom they are granted.

It remained for Congress to provide suitable enactments for carrying into practical effect these constitutional monopolies; and this has been done in the series of statutes known as the patent laws.

In accordance with the constitutional declaration, these laws provide that the original and first inventor of any new and useful improvement may obtain a patent and enjoy the exclusive right to make, sell and use his invention, and grant rights to others to make, sell and use during the short period of seventeen years, after which, the invention becomes public property and all the people are free to use it.

The object of the framers of the Constitution was to stimulate the studying out of new inventions, so that the people at large might be always supplied with multiplied successions of new and diversified industries; for by industry we thrive; by industry the resources of a country are developed, and the people made wealthy, happy and contented.

The marvelous industrial growth of this country, and its fame throughout the world as the originator and exemplifier of new industries, attests the wisdom of the fathers in writing into the Constitution that provision by which exclusive privileges—monopolies or trusts, if any one prefers so to call them—might be granted to authors of new inventions. This provision of our great charter is positive and permanent; at any rate, it cannot be changed without the assent of three-fourths of the forty-four States composing the present Union.

The decision of Judge Baker to which we have referred is that given in the case of the National Harrow Company, a New Jersey corporation, agents for or owners of a number of harrow patents, forming, it is alleged, a harrow trust. The company sued certain parties in Indiana for infringement of one of their patents. The defense was, not that they did not infringe, but that the Harrow Company was a trust, whose object was not to manufacture harrows, but to control the trade in and put up the price of harrows; objects which, they pleaded, were contrary to public policy and which the court ought not to aid or entertain. Judge Baker accepted the defendants' plea and the bill for infringement was dismissed. The judge ruled as follows:

"So far as I can perceive, the complainant is organized to receive assignments of the legal title of harrow patents, to grant back licenses to assignors to use and enjoy the same, to collect from each member of the combination or trust $1 as a license fee for each harrow manufactured and sold, to regulate and control the price at which harrows may be sold by the members of the combination, and to prosecute and defend all suits involving the alleged infringement of such assigned patents.

"It seems to me that such a combination is illegal and that its purposes are violative of sound public policy. The common law forbids the organization of such combinations composed of numerous corporations and firms. They are dangerous to the peace and good order of society, and they arrogate to themselves the exercise of powers destructive of the right of free competition in the markets of the country, and by their aggregate power and influence imperil the free and pure administration of justice.

"Complainant says that its title to the patent in question is valid, and that it has a lawful right to its protection from invasion by a stranger, regardless of the objects and purposes of the combination which it represents. On the other hand, the defendants contend that to give its title protection would be to give aid to the unlawful purposes of the combination. In suits at law it is doubtless true, as a general proposition, that a wrongdoer will not be permitted to dispute the legal title of one in possession of money or property by showing that the title thereto was unlawfully acquired, or that the owner intends to apply it to an unlawful use. I have strong doubts whether this rule ought to apply to a suit in equity, where nothing but clean hands and a good conscience will move the court to act. The combination represented by the complainant is not illegal in any other sense except that the law will not lend its aid to the accomplishment of its purposes. The common law does not prohibit the making of such combinations. It merely declines after they have been made to recognize their validity by refusing to make any decree or order which will in any way give aid to the purposes of such combinations. It seems to me that the court cannot sustain the present bill without giving aid to the unlawful combination or trust represented by the complainant. The question is not free from doubt; but in case of doubt I feel it my duty to resolve it in such a way as will not lend the countenance of the court to the creation of combinations, trusts or monopolies. They have already grown to alarming proportions, and courts, to the full extent of their powers, ought to discountenance and repress them."

If this is good law, it would seem that the provision of the Constitution and the laws of Congress concerning patents are of less value than has been supposed. Every patent granted is a monopoly or trust. Very few inventors or their agents are manufacturers. In general, the chief aim of every patentee is to establish a trust, or, in other words, to hold the exclusive control of the prices for which his invention may be used by others; and in this way he is supposed to be able to gather in the reward which the Constitution and the patent laws have promised him.

Whether an inventor or his agent or assign owns one harrow patent or eighty-one patents makes no difference in respect to his right to the protection of the laws that secure to him the exclusive control of his inventions.

The substance of Judge Baker's ruling appears to be that patents are trusts; that trusts and monopolies have grown to alarming proportions; therefore, patentees of new inventions, or their assigns, in their pursuit of infringers, are to be discountenanced, repressed, deprived of their constitutional rights and thrown out of court without a hearing.

Temporary patent trusts were regarded by the framers of the Constitution as highly expedient and desirable methods to promote the prosperity of the country. An experience of a hundred years confirms the soundness of their judgment. More than seven-eighths of our manufacturing industries were founded on patent trusts. Almost every new industry that springs up in these days has a patent monopoly for its basis. Is it possible Judge Baker is correct when he denounces these trusts as dangerous to the peace and good order of society, illegal, and violative of sound public policy?

That patent trusts are, for the short time they exist, destructive of the right of free competition in the markets of the country, we unhesitatingly admit. They were expressly intended to be destructive of competition. In no other way could the inventor enjoy the exclusive right to make, use and sell his invention.

That the free and pure administration of justice was not only imperiled, but actually denied, in the patent trust case above cited, we are also compelled, with reluctance, to admit. But we hope and believe no such miscarriage will take place in the higher court to which an appeal will doubtless be taken.

THE HEAVENS IN APRIL.

Venus is queen of the evening. In the course of the winter we have seen the celestial primacy pass from Mars to Jupiter, and now Jupiter in turn yields place and Venus asserts her superiority over her great belted brother. Still, conspicuous and beautiful as she appears, Venus is only at the beginning of her career as the evening star. During the coming month she will gain nearly 17 per cent in brilliancy. In the telescope she presents the form of a gibbous moon. It is much to be regretted that so little attention is paid to the study of Venus in the great observatories of the world. It is true that the excessive brilliancy of the planet renders the detection of its surface markings difficult, yet that fact should not deter those who have instruments of great power at their command from doing the very best that can be done to discern the real features of a globe which, at regular periods, not only approaches the earth nearer than any other planet ever does, but which, most of all, resembles our planet in magnitude and situation. All things considered, it seems to me that we should look to Venus rather than to Mars for an analogue of the earth. Venus gets almost twice as much light and heat from the sun as the earth receives. Mars gets less than half as much as the earth. Remembering the vivific power of the sunbeams, which way should we look for life? We do not go toward the frozen poles, but toward the glowing equator, when we seek the wonders of animate existence.

At the beginning of the month Venus is in Aries; at the end in Taurus.

Jupiter remains at the feet of the Twins, moving slowly eastward, and at the close of the month he will be almost between the two third magnitude stars Mu and Eta Geminorum. His cloud-enveloped globe still presents a magnificent appearance when viewed with a good telescope.

Mars, stripped of his splendors, and hardly recognizable in his abasement as the brilliant red orb that commanded all eyes last autumn, is approaching the prince of the planets as if to pay him obeisance. On the 25th they will be in conjunction, Mars passing on the north side of Jupiter, at a distance of a little less than a degree and a half. After that date their po-

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sitions will be reversed, Jupiter being to the west instead of to the east of Mars as heretofore.

Saturn is advancing in the eastern heavens and can be well seen after midnight. It is now in Virgo, a little more than ten degrees directly east of the first magnitude star Spica, and it is interesting to compare the light of the planet with that of the star. The former appears slightly larger than the latter, but it does not sparkle as Spica does, and it is not so white. The wonderful rings of Saturn can be viewed with a three inch telescope.

Uranus remains near the fifth magitude star Nu in Libra, while Neptune is still between the golden horns of Taurus, a little above a line joining the fifth magnitude stars z and Iota.

Mercury is too near the sun in the morning sky to be observed.

The month begins with the moon near first quarter in Gemini. The phase occurs on the 2d, at half past 4 P. M. The moon fulls on the morning of the 9th, in Virgo, and reaches last quarter on the evening of the 16th, in Capricornus. New moon occurs on the 24th, at 8:11 P. M. The moon will be in perigee half an hour before midnight on the 6th and in apogee at 7:44 P. M. on the 18th.

The moon's planetary conjunctions occur in the following order: With Jupiter on the 1st at 4:10 P. M.; with Saturn on the 10th at 2:42 P. M.; with Uranus on the 11th at 1:27 P. M.; with Mercury on the 23d at 11:48 P. M.; with Venus on the 27th at 5 P. M.; with Neptune on the 27th at 6:05 P. M.; with Jupiter (second visit) on the 29th at 4:27 A. M.; with Mars on the 29th at 6:56 A. M.

Venus and Neptune will be in conjunction at 6 P. M. on the 29th. The planets will be three degrees apart, Venus being situated on the north.

A few phenomena of Jupiter's satellites in Eastern standard time follow: On April 2, at 5:27 P. M., the shadow of satellite IV will pass upon the planet's disk, and will pass off at 7:51 P. M. On April 4, at 9:52 P. M., satellite I will pass upon the planet's disk; its shadow will follow at 11:07 P. M., and will remain upon the disk until after the planet has set. On April 13, at 6:19 P. M., satellite I will enter upon the planet's disk; its shadow will follow at 7:31 P. M., and will be half way across at 8:40 P. M. On the same evening, at 8:27 P. M., satellite II will be occulted by passing behind the planet. On April 21, at 8 o'clock 59 minutes and 59 seconds, satellite I will reappear from eclipse in the planet's shadow. Watch for it on the eastern side of the planet at a distance of about half the diameter of the disk.

GARRETT P. SERVISS.

THE CAREER OF A CHEMIST—A REJOINDER.

The pathetic lament of J. G. L., on page 130 of the SCIENTIFIC AMERICAN, who acknowledges his career to have been a failure, has but little to do with the sentiments expressed in the article, "On the Choice of a Career," that appeared some weeks previous. There are men, yes, and worse, who have not succeeded in the life work planned for them, not because they were incompetent, but because they were lacking in that peculiar ability of persisting in spite of obstacles that is typical of the best Americans. Grant had it and showed it when he wrote the famous sentence, "I propose to fight it out on this line if it takes all summer." Goodyear had it when he persisted in his efforts to accomplish the vulcanization of rubber, although he became an object of ridicule and was called an India rubber maniac. Ericsson had it when he built the "cheese box on a raft" that saved the Union on March 9, 1862, by driving the Merrimac under cover. Castner had it, too, when the electrolytic processes for the production of aluminum threatened the annihilation of his patents. He did not say, "I am no bookkeeper," "I cannot accept a position as a druggist," "I cannot enter a shoe store as a clerk, nor can I work as stevedore." No. He did what Grant did the close of the first day at Shiloh—namely, he gave orders for "an advance all along the lines the next morning." Finding the benefits of the aluminum process taken from him, he created the sodium industry.

I wonder if J. G. L. knows anything about the history of American chemistry. Prof. Chandler came to New York and accepted his appointment at the then newly organized School of Mines without salary, because he knew that he could make something out of it. His gratuitous services to the Board of Health in this city resulted in the creation of the office of chemist in that department for him. The younger Silliman organized a school of chemistry in the basement of one of the buildings in Yale College, and the result is the Sheffield Scientific School. He received no salary at first.

Coming back to recent years, Remsen knew what he was about when he set Fahlberg to work on those compounds among which he discovered saccharine. I am afraid there is no place for J. G. L. among chemists, and there are many who are like him. But, on the other hand, Lafayette, among our colleges, advertises for young men to study chemistry. Edward Hart, who fills the chair of chemistry there, said in 1893, in his address before the chemical section of the American Association for the Advancement of Science, "In the Lehigh Valley, Pennsylvania, a district which took the lead in the iron district, there were not at that time [1868] more than two or three persons capable of making an analysis. Now the number of persons who would come under the same head, most of them actually engaged in such work, is fifty." Dr. Peter T. Austen, of the Brooklyn Polytechnic Institute, finds places for all his graduates, and even in the same issue of the SCIENTIFIC AMERICAN as J. G. L.'s communication calls attention to "an invention needed." By the way, Dr. Austen, since his return from Germany in 1876, has never found that his "training and schooling" have made it necessary for him to regret his choice of a profession. If J. G. L. will dine with him, as I have done, and hear of the opportunities that have come to him, he will wish he was that kind of a chemist.

Perhaps J. G. L. may think that there is nothing practical in these hastily written notes. There are some persons who cannot be led; they must be driven. When I think of the good work that is being done by our chemists through the United States, I feel that there is no cause for despondency. Indeed the future is brighter than ever before. I wish my many friends in the chemical profession would testify in full to what I know only in part. If Dr. C. A. Doremus would tell what he has done for the improvement of glass, or Dr. G. W. Drummond would tell what he has accomplished in the manufacture of paints, or H. M. Murphy would tell what he has done for the varnish industry, or if Dr. Waldron Shapleigh would tell what he has accomplished for the economic production of the rare earths for artificial illumination, or if E. K. Mitting would tell what he has done for the soap industry, or if Dr. Charles M. Shepard would tell what he has done for the development of a tea industry in the country, or, last of all, read what Prof. H. W. Wiley has done for the sorghum and beet sugar industries. By talking with these men and learning what they have done then perhaps J. G. L. will appreciate what it is to be a chemist. It is such men—and perhaps my illustrations are not the best ones—who are making great strides in the advancement of our American industries, and the time is steadily approaching when American genius will make these United States the greatest industrial country of the world.

The French government sent to the World's Fair, held in Chicago during 1893, as its special representative, Prof. A. Haller, of the technical school in Nancy, to study the advances made in industrial chemistry as shown by the exhibits there. His report, which has just been issued, and sent to me by him, contains the following paragraph concerning the States. He says: "No nation in the world possesses such wonderful natural resources and in no other country is it possible to produce under equal conditions of cheapness. And the time will come when it will have men educated to appreciate this condition of affairs and who know the state of European industries. Then the artificial conditions that have existed for almost a half a century will come to an end."

I commend this article to J. G. L.

New Englanders the Finest Mechanics in the World.

Hiram S. Maxim, the inventor of the Maxim gun, who has had a large experience during many years in manufacturing in various countries, and who ranks personally as a great mechanical expert, has the following to say, in a recent interview published in the New York Sun, touching the skill of the mechanics of different countries:

"Regarding the comparative skill of mechanicians—American, French, British, Spanish, German—it would be impossible for me to mention one nation that excels in everything. Each nation has its own peculiarities and its own specialties. So far as my experience goes, and I have had a great deal of it, I should say that the New Englanders are the finest mechanics in the world. I think any one who has investigated the subject will have to admit this. The tools which are designed and made in New England are incomparably ahead of those made in any other country. There is nothing in Europe that can at all compare, for instance, with the tools made by Brown & Sharpe, of Providence, R. I., Pratt & Whitney, of Hartford, Conn., and the American Tool Company, of Boston. The Americans also excel in the manufacture of revolvers and sporting rifles, while for wood-working tools and machinery they are far ahead of all other nations. They are also ahead in automatic machinery for working metals and also in boot and shoe machinery, etc. There are, perhaps, about as many great inventions made in the United States as in all the rest of the world. The English may be considered the most skillful manufacturers of high class woolen goods. They are quite equal to any in the manufacture of velvets and plushes. The hand-made double-barreled guns used for sporting purposes have reached a higher degree of excellence in England than in any other country. The English also have a leading position as builders of ships and marine engines. Microscopic and photographic apparatus is also very well done in England.

"I find that the Germans are very good mechanics; they are quick to appreciate the advantages of a new system and to adopt it. The German tool makers have profited very largely by the introduction of American tools. Only a very few such tools, as, for instance, milling machines, etc., are imitated in England, but the Germans imitate every mortal thing of any value made in the States, and their work is only slightly inferior to that of the Americans. I have purchased and compared genuine American tools with German imitations, and have found that the castings of the former are sounder and stronger, and that the deviation from truth, though very small, in the German tools is three or four times as great as in well made American machines. The Germans excel in all sorts of cheap bronze articles, colored printing, etc. While the Austrians are very backward in tool making, they excel in leather work.

"The Frenchmen are all-round good mechanics. The imitations of American tools made in France are nearly as accurate as the genuine articles themselves, while their instruments of precision are quite as accurate as those made in the States, but they are not made in quantities as is done there, and so the price of the French instruments is four or five times as great as the American. The French are a nation of workers; they seem to like it, and I believe, everything considered, the Frenchman is the best mechanic in Europe.

"In regard to Spanish mechanics, the number of manufactured articles which the Spaniard excels in is exceedingly small. Steel work inlaid with gold and silver and Damascus steel are their specialties. Some of this is very beautifully executed, and perhaps superior to anything else that is done in the world.

"Forty years ago England was by far the greatest manufacturing nation in the world. In America, if any one wanted a good saw, a good plane, a reliable file, or a chisel that could be depended upon, he insisted that it should be made in England; nothing except of English make would bring a fair price. At the present moment the Americans not only make their own tools, but are exporting largely to England. At the time when it was necessary to pay forty per cent duty on English steel to get it into the United States the Americans purchased it, paid the forty per cent duty, manufactured it into twist drills and other small articles paid about one and a half times the daily wage demanded in England, and sold at a price considerably below what the same work could be produced for in England a much better article than ever had been made in England. Take the Morse twist drills, for instance. I have no doubt that these are largely manufactured from English steel on which a duty has been paid. Still, they are very largely sold in England today. In fact, if anybody wants a reliable one, they always demand the American drill made by the Morse Twist Drill Company.

"A few years ago while in St. Petersburg I visited a large dealer in hardware. I asked him where his tools came from. He said: 'Originally we got nearly everything from England. At the present time the very cheap and poor tools are made in Russia, the common tools that we sell to everybody are made in Germany; we get a few articles from France. From England we only buy a few Stubs' files, reamers, and engraving tools, while our very high priced instruments of precision, such, for example, as micrometer calipers, squares, scales, rules, etc., come from the United States.' He told me that the sale of English goods had fallen off lately so much that he was only selling a small fraction of what he originally sold.

"Some few years ago, if any one in Europe wanted a drill press, a turning lathe, a planer, or shaping machine, he was sure to get it from England. When the German government decided to make their rifles on the American interchangeable plan they purchased from Messrs. Pratt & Whitney, of Hartford, Conn., about $1,500,000 worth of American tools. These were brought to Germany, and a very enterprising manufacturer in Berlin, seeing the great advantage of the American style of tools over those of European make, established a factory and commenced to build them on a very large scale. To-day this enterprising manufacturer has not only practically driven the English tools from the market on the Continent of Europe, but he is also sending tools to England and selling them at prices considerably below those of English tools, and moreover, as they are close copies of American designs, they are found to be much handier and better adapted to the work than tools of English design."

Good Business Maxims.

Carefully examine every detail of your business. Be prompt in everything. Take time to consider and then decide positively. Dare to go forward. Bear troubles patiently. Be brave in the struggle of life. Maintain your integrity as a sacred thing. Never tell business lies. Make no useless acquaintances. Never appear something more than you are. Pay your debts promptly. Shun strong liquor. Employ your time well. Do not reckon upon chance. Be polite to everybody. Never be discouraged. Then work hard, and you will succeed.—Notes and Queries.

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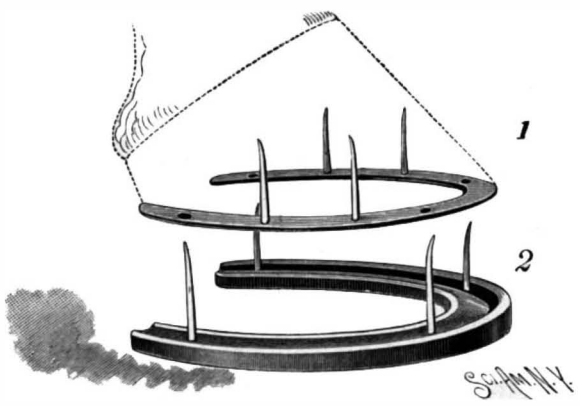
A COMPOUND OR DOUBLE HORSESHOE.

The illustration represents a shoe of which one section forms a light racing shoe, to be permanently nailed on, while the other, much heavier section, is recessed to fit over the racing shoe, and is temporarily nailed on over it, the shoe being thus used in its compound form when the horse is in training. The improvement has been patented by Mr. Erasmus Richardson, of Esbon, Kan. The outer shoe furnishes the weight desired for training purposes, while the light inner section preserves its sharp edges for a good hold upon the ground, reducing the liability to slip, and

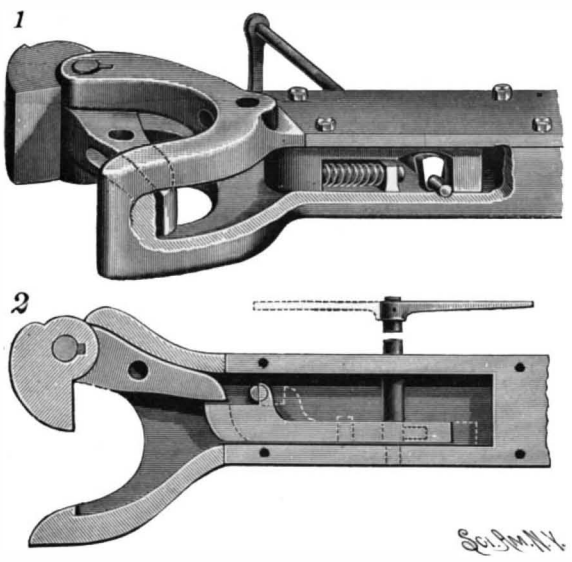


RICHARDSON'S HORSESHOE.

lightening the horse's feet to enable him to do his best work. The invention is also designed to lighten the expense of shoeing, lessening the putting on and pulling off of shoes and the consequent additional mutilation of the hoof.

A TWIN-JAW, AUTOMATIC CAR COUPLER.

The engraving represents a coupling of the Janney type, the uncoupling of which may be effected from the side of the car, while the improvement affords convenient means for making linked connection with a disabled coupling or one of the ordinary link and pin style. A patent has been granted for this invention to Mr. William Dunlap, of No. 1222 Sixth Street, San Diego, Cal. The peculiarly formed knuckle piece has a tail piece which extends nearly at right angles from the latching head, and the ears on the drawhead and the knuckle piece receive a pivot bolt with a collar which is countersunk, there being a locking toe in the head of the bolt. The bolt is made in two portions, its main lower portion affording a swing joint for the knuckle head, and a strong spiral spring, having its upper terminal attached to the bolt head, is attached at its lower end to a collar on the upper part of the main lower portion of the bolt. A spline or feather key in the side of the pivot bolt interlocks with a groove in the knuckle piece, and when the parts are in place the torsional force of the spring is exerted to normally throw the free end of the tail piece forward, as shown in Fig. 1. In the rear of the drawhead is a latch bar, as shown in the sectional plan view, Fig. 2, a recess in the bar affording space for a guide rod surrounded by a spiral spring, one end of which abuts against the front shoulder of the recess, while its other end abuts against a lug in the lower wall of the draw-



DUNLAP'S CAR COUPLING.

head. The latch bar is withdrawn by a cam block on a shaft which extends to one side of the car, where it is provided with a crank, the free reciprocation of the latch bar being permitted when the crank hangs pendent, as shown in Fig. 1. On the meeting of two cars provided with this coupling, the knuckle heads pass each other and rock the tail pieces rearwardly, the front ends of the latch bars then engaging the tail pieces at the same time that the knuckles become locked in coupled position, which is shown in Fig. 2, the uncoupling being effected by turning the crank handle to release the latch bar, as indicated by the dotted lines. To couple with a car having an ordinary link and pin coupling a vertical perforation is made centrally near the front of the drawhead proper, to receive a common coupling pin, the tail piece being also similarly perforated with the like object.

Asbestos Adapted to Modern Wants.

The uses of asbestos are almost innumerable. Ground fine and combined with colors and oils by a secret process, it makes a beautiful paint, which is said to go far toward fireproofing the surface to which it is applied. Various kinds of roofing are also made by treating strong canvas with a combination of asbestos and felt and backing it with Manila paper. It is extensively used for roofs of factories, railroad shops, bridges, steamboat decks and other places where there is danger of fire.

Nearly every one has seen the thick asbestos felt covering for steam pipes and furnaces. Asbestos cement is sometimes used for hot blast pipes and fire heated surfaces. As a packing for locomotive pistons, valve stems and oil pumps it is almost indispensable. It is also made into ropes and millboards, which can be used almost everywhere. Asbestos cloth is being used more every year. Some States require theaters to use an asbestos drop curtain to protect the audience if the scenery catches fire. Some very beautiful drop curtains have been made, and the ordinary spectator cannot distinguish them from real cloth.

The yarn is knit into mittens for workers in iron and glass, says the Chicago Record. Goldsmiths use a block of asbestos to solder upon. Combined with rubber—vulcanized—asbestos has almost innumerable uses as an electrical insulator. In this form the substance resembles ebony, and is about as hard. The cloth is also of the greatest importance for acid filters in all kinds of chemical processes, for the reason that no acid will eat it.

Asbestos is found in a good many hundreds of places in the world besides Italy and Canada, but the fibers are nearly all too splintery and brittle. Rich deposits have recently been found in Wyoming, California and Montana, and the United States may soon come to the front as a producer of the substance. In 1893 California produced 50 tons of asbestos, valued at $2,500, while Canada sent out 6,473 tons, valued at $313,806. A good mine of asbestos is more valuable than a gold mine, and as the substance becomes better known and more used it will be still more precious. The time may not be far distant when firemen will be clothed in suits made from asbestos.

First Report of the Commission on Tuberculosis in Cattle.

The first annual report of the State Commission on Tuberculosis in Cattle has been presented recently to the State Legislature of New York. The investigations have been carried out with great care and thoroughness and the report contains much valuable information. It is not generally known that the statistics show that tuberculosis causes one in every eight deaths in this State. This fact, it will be seen, makes the work of the commission of the utmost importance.

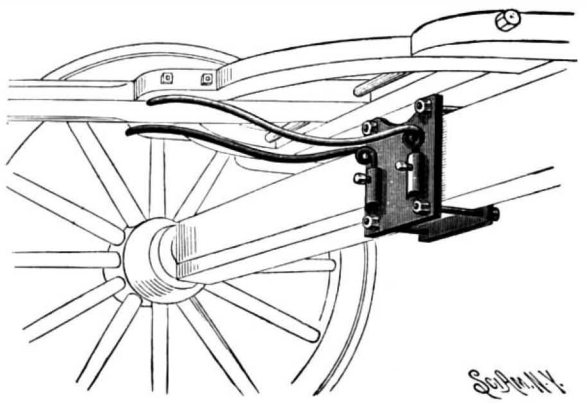
The present commission was constituted in May, 1894, to make a special inspection of the prevalence, distribution, mode of inspection and general behavior of tuberculosis in cattle. The work which furnishes the material for this report was confined to a given area which was considered comparatively free from infection. In this district 947 animals were examined, and of this number 66 were condemned and slaughtered. A large proportion of these animals were common stock, and all breeds of cattle seemed to be affected alike. Tuberculosis in cattle has been found wherever examinations have been made. It has been discovered that the general diffusion of tuberculosis is due to contagion. The disease has been found to spread with certainty when the animals are housed together. The affected animals often show no evidence of the disease by objective signs. Often the diseased animals gave plentiful supplies of milk. The commission therefore urges that a scientific inspection be made regularly. It recommends that some central authority be established which will exercise a strict supervision. The commission has conducted experiments with the imported Koch tuberculin and with the tuberculin from the Bureau of Animal Industry at Washington, and has found them equally valuable. As far as possible, the object lessons given by the commission have reached all who might profit by them. Many dairymen in consequence are now engaged in examining their own cattle. The trouble and expense of disseminating this knowledge is certainly justified by the importance of the work.

Design Patents.

In the case of the Braddock Glass Company v. Macbeth, for infringement of a design patent for a lamp chimney, the United States Circuit Court of Appeals, third circuit, upheld the well-known rule of law in such cases and decided in favor of the plaintiff. The court said: "The novelty of a design is to be tested, not by investigation of the means employed for its creation, but by ocular comparison of the design itself with the prior designs in the art."

AN IMPROVED WAGON TONGUE SUPPORT.

The device represented in the engraving may be quickly and easily applied to the wagon axle without in any way weakening the latter. The improvement has been patented by Mr. John F. Dehm, of San Diego, Cal. It consists of plates attached centrally to the front and rear sides of the axle by means of bolts, elongated lugs on the outer face of the front plate being apertured to form sockets to receive spring-supporting arms. The latter are preferably of stout wire and have a vertical section held in place in the socket by a set screw, the vertical and horizontal sections of



DEHM'S WAGON TONGUE SUPPORT.

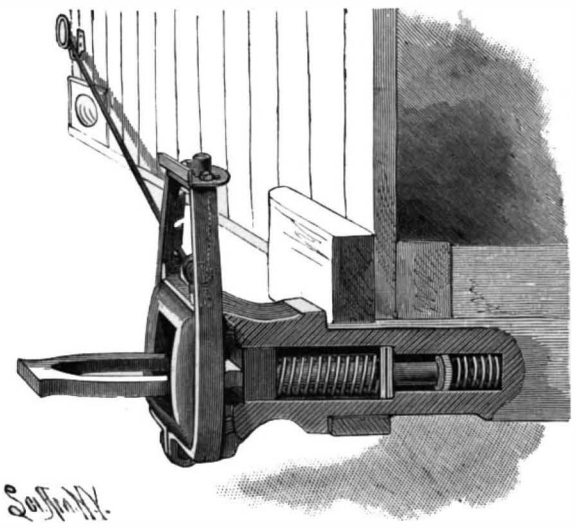
the arms being connected by a coil. It is not necessary to connect the spring arms to the tongue.

Exhibition of Patents and Inventions, New York City.

The above exhibition at the Grand Central Palace, this city, has attracted considerable attention during the past few weeks and is drawing to a close. A number of ingenious inventions have been shown, the exhibition as a whole somewhat recalling the American Institute annual fairs. We cannot well undertake to particularize the things which were to be seen there. Edison's kinetoscope, Lennard's bullet proof coat, any number of car fenders, Mr. Webb's beautiful model of the New York Central locomotive, Empire State, and Leistner's building blocks being among those which first met the eye. The latter are a most ingenious addition to the building resources of the child. Six different bars comprise a set, and of such bars a hundred or more are supplied in boxes.

AN IMPROVED CAR COUPLING.

The illustration represents a simple and inexpensive coupling, adapted for automatic coupling and conveniently manipulated for uncoupling from the side of the car. The improvement has been patented by Mr. Jasper A. Sissom, of Galena, Kansas. The drawhead has two intersecting chambers of differing diameters, in which a pusher rod is supported to slide endwise, the rod having a head block at its front end and guide blocks at about its middle, while at its rear end is a tail block. A heavy coiled spring on the front end of the bar tends to hold the head block against the throat piece of the drawhead, there being also a re-enforcing spring at the rear of the tail block. The coupling link is flattened at its



SISSOM'S CAR COUPLING.

ends, and is placed in position for coupling by being pushed against the head block, compressing one of the springs and permitting the pin to drop by gravity, the spring then pushing the link against the pin and holding the link in the position shown in the illustration. A yoke frame clamped upon the forward portion of the drawhead, and having a cross bar connecting its side members, affords a vertical guideway for the coupling pin, which is connected with the inner end of a lifting rod extending to one side of the car, the pin being raised to uncouple by successively resting the adjacent part of the rod on rack teeth on one of the side bars of the yoke frame. A car having only the ordinary link and pin coupling may be readily coupled with one provided with this improvement.

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The Holly Gravity Return System.

In a steam engine plant, this system is designed to return the water of condensation and entrainment without employing a pump or trap, by means of a simple open circuit, returning the water from below the boiler as if the boiler was below the surface. A single system receives and delivers the condensation from all the separators, drips, cylinder jackets, etc., effecting a saving of coal by returning the water to the boiler at very nearly boiler temperature. The system does not involve any mechanical movement and requires no attention after it is once put in operation. It has been placed in some of the best equipped power stations in the country, and is now being put in at the power station of the Metropolitan Traction Company, of New York City.

AN ATTRACTIVE HOUSE.*

The very attractive house represented herewith in perspective is estimated to cost $5,500. The cost of building materials and labor varies of course in different localities, but this is the estimate stated in American Homes, published at Knoxville, Tenn., for that section of the country.

The first story is of brick and the second story of shingles. Gables timbered and plastered. The staircase in the front hall is so arranged as to make the hall a nice, comfortable sitting room. On the stair landing is a handsome art glass window, producing a beautiful effect, both from inside and outside. Four pairs of sliding doors throw all the main rooms and hall practically into one room. The second floor has four large chambers, but the number may be increased by reducing their size.

The interior is finished on first floor in hard woods for main rooms, and whitewood stained or painted for second floor. Cellar under entire house. Plumbing and water supply complete. Roof is shingled, but slate would be better at a slight additional cost.

Size, 48 by 67 over all, except steps. Height of first story, ten feet; second story, ten feet; cellar, seven feet.

* Engraving from American Homes, published at Knoxville, Tenn.

JEANTAUD'S ELECTRIC CARRIAGE.

In the interesting competition of automobile carriages organized in the month of July, 1894, by the Petit Journal, every one remarked with great surprise and much regret the absence of electric carriages. Only one was entered, and that was held in the custom house by various formalities. We have already described some models of such carriages devised by various amateurs, but we must recognize the fact that up to the present the electric carriage has left much to be desired in its operation and has not given very satisfactory results. Must we blame the source of electric energy and the complex transmissions from the motor to the wheels for this? The blame might be equally ascribed to all these parts.

Mr. Jeantaud, a carriage maker of Paris, has just made a long stride toward the electric carriage. He has been studying this question, he tells us, for about fifteen years. He has had the wisdom to mature it without stopping at the results of an incomplete invention, and to ever seek a really practical solution and one capable of industrial application. He has finally succeeded in constructing a carriage which, after a trial by Mr. Michel Levy, engineer of mines, has been authorized to run freely around Paris.

Fig. 1 gives a general view of the carriage, which is a four-wheeled phaeton with a seat for two and with accumulators. There is a box placed in the rear for the reception of the latter. In front is the steering axle, which is the same as the one now employed in all automobile carriages, which Mr. Jeantaud was the first to apply, and which is provided with a long rod within reach of the driver. Under the carriage there is suspended an electric motor that transmits motion to the hind wheels. A commutator is placed in front. Beneath the driver's foot there is a pedal that controls a circuit breaker and the brake. The weight of the vehicle and transmissions is 1,078 pounds, and that of the accumulators 925, inclusive of 615 for the plates and 310 for the liquid and the boxes. The motor weighs 240 pounds. Admitting an average weight of 330 pounds for two passengers, we reach a total weight of 2,573 pounds.

The source of electric energy consists of a battery of accumulators of the Fulmen type, of 21 elements distributed through 7 boxes of 3 elements each. Each of these accumulators contains 29 pounds of plates and is capable of furnishing, in normal operation, a capacity of 300 amperes-hour at a discharge of 30 amperes, of 240 amperes-hour at 40 amperes, and of 210 amperes-hour at 70 amperes. It will be remarked that it is a question here of discharges reaching as high as 3 amperes per pound of plates. In some particular cases, and certainly exaggerated ones, Mr. Jeantaud has been able to obtain discharges varying from 80 to 180 amperes, but for an hour and a half only. The capacity was 11 amperes-hour per pound of plate in the first case cited above and 7·5 in the last. The accumulators are mounted in tension, and keep this coupling constantly. From these figures, it may be remarked that the new accumulators are distinguished by a great capacity and by the high discharge that they are capable of furnishing, in resisting jarrings and shocks. These properties they owe to their very structure. The plates, which we have been able to examine at the works of the company, are formed of an internal mounting with honeycombings that are filled with active material, and the whole is inclosed between two celluloid plates containing apertures of small diameter. These celluloid coverings are in turn united and cemented at the top and bottom. A series of similar plates is grouped between them and mounted

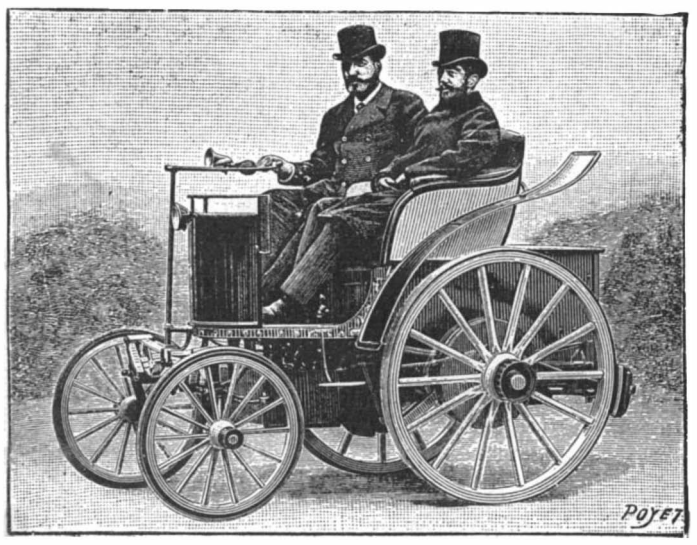


Fig. 1.—JEANTAUD'S ELECTRIC CARRIAGE.

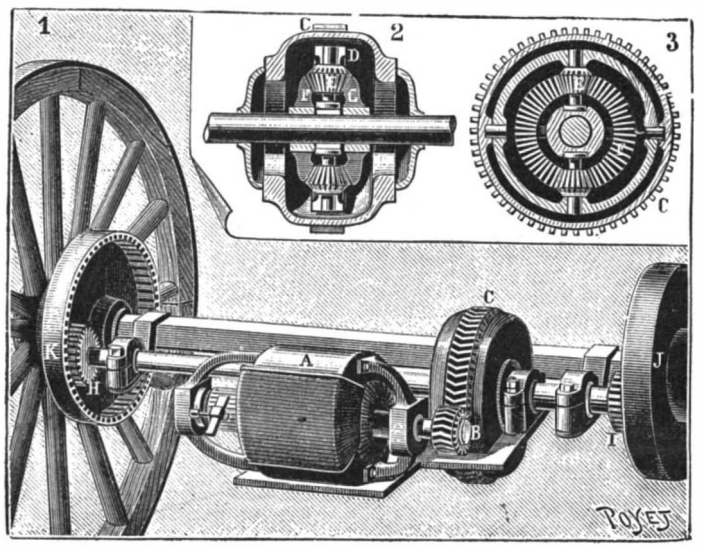
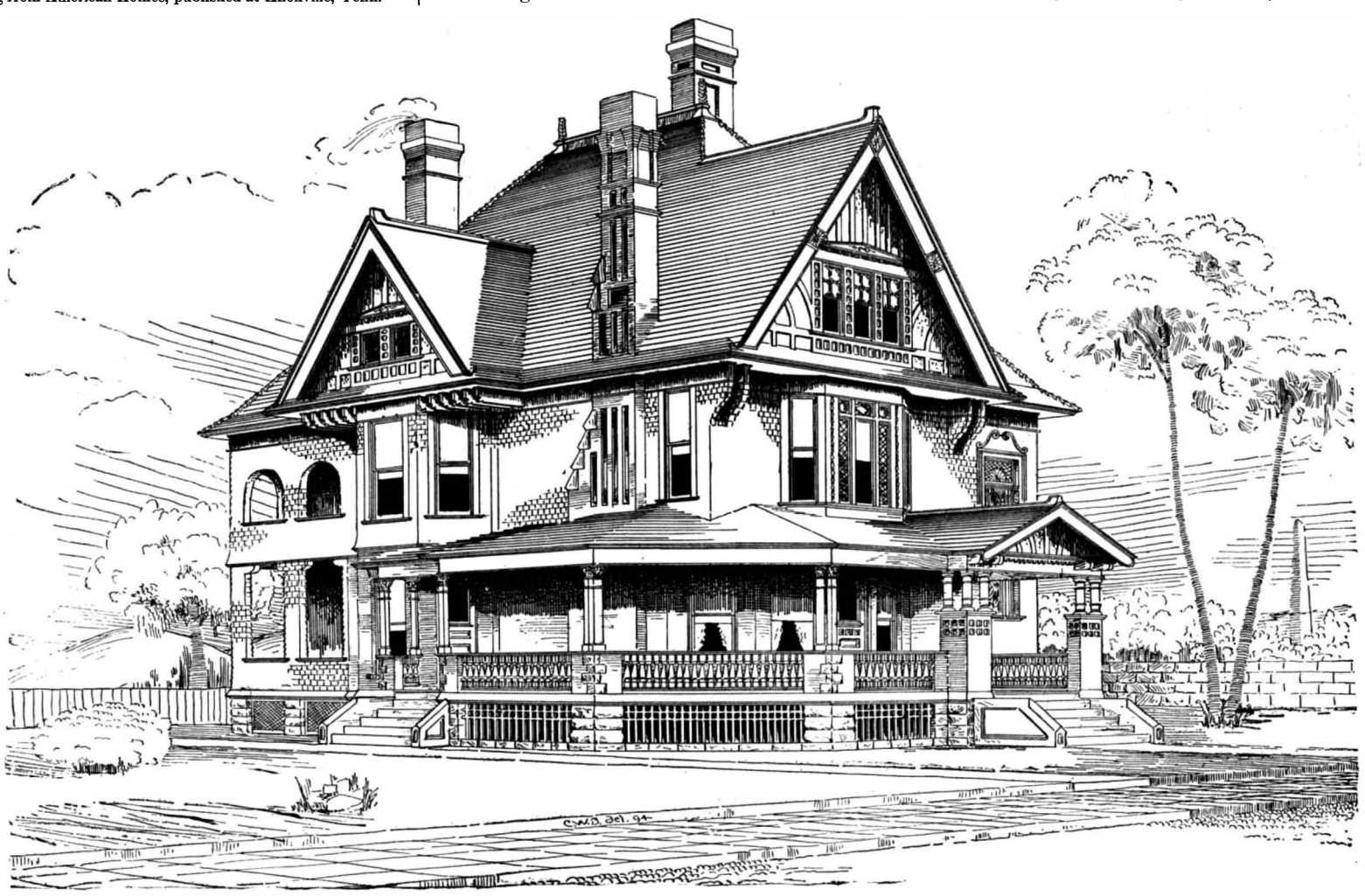


Fig. 2.—DETAILS OF THE MECHANISM.



PERSPECTIVE VIEW OF AN ATTRACTIVE HOUSE.

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as in ordinary accumulators. These elements can thus be submitted to shock, jarring and variable discharges. The active material remains in the receptacles, and the accumulator undergoes no deterioration. These are observations that Mr. Jeantaud has been able to make with the accumulators that he has employed in his carriage and that he has very often submitted to difficult experiments.

The motor is a series one constructed by the Compagnie de Fives-Lille. It produces 2·6 horse power at an angular velocity of 1,200 revolutions per minute, and an industrial rendering of 74 per cent, with the bobbins of the inductors mounted in tension. Upon coupling these latter in quantity, the duty may reach 4·4 horse power at an angular velocity of 1,300 revolutions per minute. The industrial rendering is then 70 per cent. The motor is suspended from the carriage box by flat springs, which deaden the shocks at the moment of stoppages. As we shall see further along, arrangements have been made to allow the motor to follow the inflexions of the carriage box without the teeth of the transmission gearing ceasing to mesh normally.

Fig. 2 (No. 1) gives an internal view of the transmitting mechanism, and the figures in the upper right hand corner represent the arrangements adopted for the differential system. The transmission of the motor is realized without chains and pertains to the Gaillardet model. It is effected through the intermedium of a shaft revolving in two pillow blocks fixed to the axle and carrying at its two extremities two pinions with straight toothing, I and H, engaging with two drums, J and K, toothed internally. These two drums are fixed to the hubs of the wheels of the carriage. The shaft mentioned above carries a gearing, C, which is mounted upon a Cardan joint and is directly controlled by the pinion, B, of the motor, A. We cannot dwell too long upon these internal arrangements, but the details of the various pieces, C D, of the Cardan joint, and of the pieces, E, F and G, of the differential system may be seen in Fig. 2.

The maneuvering of the carriage is exceedingly simple. The starting offers no difficulty, and the stoppage can be effected almost instantaneously through a winding brake upon the hub of the wheels. This brake controls wooden blocks that bear against the tire of the hind wheels. The maneuvering of the brake is very easily done through a pressure upon a pedal. At the same instant a circuit cutter placed upon the latter interrupts all communication with the source of electric energy. The results obtained up to the present by Mr. Jeantaud are as follows: The carriage, of a total weight of 2,573 pounds, and with a complete charge of accumulators, is capable of making a trip of 18 miles at a maximum speed of 12 miles an hour upon a good level road. Such speed may be reduced at will. These results have been obtained in one hour and a half upon a dry macadamized road presenting gradients of 1·25 to 1·5 inch to the yard each for a length of 800 yards. Mr. Jeantaud is at present constructing another carriage capable of making a trip of 36 miles.

Upon the whole, the new electric carriage does not, as yet, permit of undertaking long trips, but it is distinguished by good construction, by great strength, and by very simple and really practical arrangements that permit of opposing it without fear to the petroleum carriages that have been so much talked about in recent times. We can, therefore, now assert that we are not far from finally knowing the electric coach that Mr. Hospitalier has so often called for so ardently. —La Nature.

Astigmatism—What it Is and What it Does.

Since by recent discoveries in the glassmaker's art, and in new properties in certain of his productions, the terms "astigmatism" and "astigmatic" or "non-astigmatic" are becoming more common than they were only a few years since, we find them occasionally glibly made use of by some who have no idea of what is meant by such terms. Questions are sometimes asked about astigmatism of about as intelligent a nature as was put by a purchaser of a lens who stipulated that the one to be supplied must have an optical center, and that, if this wore out by fair usage, another optical center must be refitted to it!

It is only since the advent of photography that astigmatism could possibly have applied to any optical instrument, for in no other than a photographic lens is there any recognition of the transmission of a ray obliquely through it, and obliquity of transmission is a condition inseparable from the production of astigmatism, or astigmation, as it formerly was, and still is occasionally, called. There is no astigmatism in a telescope object glass when employed as such, because the rays pass through it axially and not obliquely; but, if mounted as a photographic lens, it speedily shows that it, too, obeys the law which all achromatic lenses have hitherto recognized as regards astigmatism.

What, then, is the nature of astigmatism, and by what means is it to be discovered? Let us take any ordinary achromatic objective and subject it to critical examination by means of the ground glass focusing screen of the camera. The object to be focused may be a circular white object the size of a threepenny piece, or it may, perhaps with greater advantage, be a sharply cut white cross, or both, mounted upon a black ground for facilitation of clear observation, or a black cross drawn upon a white card, the limbs of the cross being placed vertically and horizontally. The lens in the camera should be used without a stop, for the larger the aperture, the more apparent will be the phenomenon. Let the camera be placed so that the image of the foregoing objects shall be sharply focused on the center of the ground glass screen, and it will be found that the circular one will be quite round and distinct, while both the vertical and horizontal limbs of the cross will be equally distinct, while, if the lens be racked in or out of focus, both will preserve their shapes, notwithstanding the indistinctness of outline necessarily caused by this treatment. The camera is next rotated until the objects are brought to the extreme side of the focusing screen, and the racking in and out proceeded with as before. Neither the disk nor the cross will be found to be sharp anywhere, but it will be noted that, at one position, the disk will be elongated vertically, being oval in shape, while, on racking the lens a little the other way, the elongation will now be horizontally, but the mean of the two distances will not show it to be of circular form. With the cross, at one distance the horizontal bar will disappear almost, if not altogether, leaving the vertical one only sharp and distinct, to disappear in its turn when, by an opposite turn of the rack, the horizontal one is brought into visibility. The distance through which the lens has to be moved to produce these phenomena shows the amount of astigmatism possessed by that individual lens at that degree of distance from the center of the ground glass, for at the center, as we have shown, sharpness and correctness of form prevail, the amount of astigmatism usually increasing as the center is departed from. We say usually, but this is not invariably the case, for in making charts of the amount of astigmatism given right across the whole field by lenses in our own possession, we find that over a considerable portion of the surface adjoining the center there is no appreciable astigmatism to be found until we approach much nearer to the margin. Noting that there are two foci to every point projected upon the focusing screen, and that one gives the image as a vertical line and the other as a horizontal line, it is a comparatively easy matter to construct a diagram or chart for every lens that passes through one's hands which will show not only its curvature of field, but the amount of astigmatism, from perfection or freedom from this evil at the center to the full development of the unwished-for propensity at the margin, represented by two lines running alongside each other, and usually drifting apart as they approach the sides of the plate.

It would occupy too much space to give in this article an account of the astigmatometer we devised and constructed for the purpose implied; suffice it to say in the meantime, and pending its publication on some future occasion, the whole capabilities, the failings and, in short, the character in this respect of a lens may be delineated with accuracy on a sheet of paper the dimensions of the ground glass, and this in about ten minutes after erecting the camera.

Having said so much about the nature of astigmatism, we shall dismiss its cause in a rather summary manner, contenting ourselves by a repetition of the explanation we once gave when bringing the subject before the now defunct Photographic Society of Scotland. Astigmatism, we said, arose from the obliquity of the cylindrical pencil of rays causing the aperture of the lens to cut it in an elliptical form. As the refractive power of the margin of the lens is equal all round, it follows that the refractions at the horizontal margins of this ellipse are as great as at the vertical margins; consequently the inclination of these rays toward one another is as great in one case as in the other; or, to put it another way, the angle at the focus, formed by the extreme rays of the pencil, is the same horizontally as perpendicularly; but, as the base line vertically is longer than the horizontal one, it follows that the focus of the vertical rays is further from the lens than the horizontal ones, so that for oblique rays there are two pseudo foci. Now, at the short focus, a point will be represented by a vertical line; at the long focus, by a horizontal line; and intermediately, by a combination of both. This accounts for the impossibility of getting anything sharp at the margins when some lenses are being employed. It is possible to arrange the curves of the lens so that even with full aperture there shall be what photographers term great "depth of focus," the meaning of which is, that no part will be in sharp exact focus, but that objects situated at varying planes shall be all pretty near it. A lens of this character is unsatisfactory, and is to be avoided.

A small aperture to a lens improves the marginal definition, the reason of this being that, as each point of the subject is represented by an irregular dot, the smaller the dots the less does their irregularity interfere with one another. The marginal smudginess which thus results from astigmatism is, as we have hinted, greatly minimized, and in some cases practically extinguished, by a small stop.

But lenses, formed of special glass, have of late been placed upon the market with a claim of their being free from astigmatism, even when used with a large aperture. This we rejoice at, not merely as an optical feat once thought impossible of accomplishment, but on account of the additional power thus placed in the hands of photographers, who like good definition all over the plate, but who may not desire it at the expense of having to secure it by the use of a small diaphragm. It is a pity that objectives of this nature, from the complexity of their construction—some having as many as eight individual lenses—and from patent restrictions, are not likely to be supplied at what have been designated "popular prices." The influence of time may, however, aid in the amelioration of this drawback.—British Journal of Photography.

Atmospheric Electricity.

Professor A. Schuster lectured recently at the Royal Institution of Great Britain upon "Atmospheric Electricity." When this science was but in its infancy, it was noticed how the spark of a battery resembled thunder and lightning, and the idea soon became generally, although somewhat vaguely, accepted that a flash of lightning was only a form of electrical spark, while it was left for Franklin, who had long suspected that a thunder cloud was charged with electricity, to establish by experiment a complete parallelism between lightning and electricity. This he successfully accomplished in the year 1752, and on his researches are based the complete understanding we now have as to the various phenomena of atmospheric electricity. After briefly alluding to Franklin's and Faraday's work in connection with the subject, the question of the origin of the "lines of force" was discussed, and Professor Schuster passed on to consider the various causes of de-electrification which are constantly going on. Important factors are fires; these discharge electricity constantly, and it was pointed out incidentally that factory chimneys themselves act as good conductors of electricity, better even than the lightning rod which is fixed to the summit. Having pointed out that the theory sometimes put forward as to the disappearance of the "lines of force" by passing away from the air into space was untenable, the professor showed that on rising in the air the "lines of force" at first increase, but at altitudes of 15,000 to 20,000 feet they end. Their disappearance, however, depends upon the condition of the atmosphere, as in very fine weather they end at 12,000 feet. The fact that electrical effect in the atmosphere is dependent upon the moisture present is well established, but some observers have had an idea that it is influenced by solar radiation instead, and an instance was cited which showed that electrical effect in Germany was directly connected with a dust storm which occurred in Alexandria, the electrification not being shown before the storm.

In discussing the effect of lightning upon trees, statistics showed that forty-eight oak trees are struck to one beech tree, the ratio being dependent upon the amount of oily matter contained. Some curious effects of lightning having been described, a series of photographs were shown illustrative of various types of flashes, and after briefly alluding to silent discharges, the professor described the phenomenon known as St. Elmo's fire. This name is derived from St. Erasmus, who was the patron saint of the Italian sailors. Its peculiarity is that it appears as either positive or negative, one condition being as probable as the other. The phenomenon is simply one of induction. The various hypotheses which have been advanced to account for atmospheric electricity were briefly noted. Their name seems to be legion, as they number since 1753 more than a score, while the year 1884 alone produced five new theories! Of this number the rotation of the earth, direct radiation, heat, and evaporation may be mentioned, and an instance was given where, from personal observation, electrical effect was shown to be due to the actual formation of cloud. Speaking of the aurora borealis, it was mentioned that it seems to be connected with cirrus clouds at low altitudes, and that the many spots in the sun have been sometimes attributed to the existence of many auroras. The lecture was profusely illustrated by experiments, all of which passed off without a hitch.

Exposition in Mexico.

A great International Exposition of Industries and Fine Arts, authorized by the Federal government of Mexico, by concession dated January 9, 1895, will be inaugurated in the city of Mexico on the 2d of April, 1896, and will remain open for a period of at least six months. This will be Mexico's first exposition.

It is to include all kinds of industrial, scientific, commercial, and artistic productions, and to embrace, in fact, the whole range of human activity.

The Exposition grounds are situated at the foot of the castle of Chepultepec, on the grand avenue De la Reforma, within ten minutes' ride from the center of the city of Mexico, and comprise an area of about 600 acres.

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THE AMSTUTZ ELECTRO-ARTOGRAPH.

The advent of each year is made attractive by the development of some new and useful invention for the use of humanity, or, possibly, by the improvement of what was supposed to be an already perfected idea. That improvements in the general use of the electrical current would continue was naturally to be expected, considering the greater knowledge of its laws each year brings to the engineer who makes a study of this marvelous agency.

When the telephone was introduced to the attention of the world, and the human voice was made audible miles away, and also when the phonograph, with its capabilities of storing up the human voice, was made public, there were dreamy visions of other combinations of natural forces by which even sight might be obtained of distant scenes through inanimate wire.

It may be claimed, now, that though we do not see an object miles distant through the wire, yet this same inanimate wire and electrical current will soon serve us, automatically, as both artist and engraver, transmitting and engraving at the same time a copy of a photograph miles away from the original.

Mr. N. S. Amstutz, a well known mechanical and electrical engineer of Cleveland, Ohio, has brought out of the elements an invention by which this is accomplished. As will be seen by the workings described, it might appropriately be termed a marriage of the phonograph and telephone, as the features of these two inventions are allied in this, called by Mr. Amstutz, electro-artograph. The object of the invention is to transmit copies of photographs to any distance, and reproduce the same at the other end of the wire, in line engraving, ready for press printing.

The undulatory or wave current is used, as in the telephone, while the reproduction is made upon a synchronously revolving, waxed cylinder, as in the phonograph. There is required for this end both a transmitting and receiving instrument, views of each of which are shown in our illustrations, from sketches made from the instruments in use by Mr. Amstutz.

The principle by which this work is accomplished is quite simple, and will readily be understood by reference to the diagrams shown, Fig. 3 representing the transmitter and Fig. 4 the receiver.

An ordinary photographic negative is made of the subject to be transmitted; an exposure is made under this negative of a film of gelatine, sensitized with bichromate of potash, and by which the effect is produced of rendering insoluble in water the parts exposed to the light passing through the thin portions of the negative, while those portions protected from the action of the light can be dissolved away; the capabilities of dissolving away varying with the intensity of shade or light upon the negative. After dissolving away the soluble portions from the film there will remain the same picture as appeared on the negative, but it will be entirely in relief. We show a section of such a film, exaggerated, in Fig. 5, in which the variations upon the surface represent the varying effects of the light and shade of the picture.

This film is now attached to the surface of the cylinder, A, Fig. 3, and caused to revolve; a tracer or point, B, adjustably connected to a lever, C, rests upon the film, and as the film revolves, rises and falls with the undulating surface of the film and communicating an up and down movement of the end of the lever, C, in a multiplied degree. A number of tappets or levers, F, are centrally fulcrumed at D and arranged so that one end presses upward on the lower end of terminals, E; the opposite ends of the tappets varying in distance from a horizontal line over the end of the lever, C, as shown. When the lever, C, is at its lowest point, as influenced by a depression in the gelatine film, all the tappets press up against the terminals; with a further revolution of the cylinder, A, and an elevation in the film forcing the lever, C, upward, all of the tappets' contact with the terminals, except one, is broken. The height of the hill and depth of valley of the film's surface meausuring the number of tappets in contact with the terminals.

One terminal of a battery, N, is grounded and the other is connected to the fulcrum, D, of the tappets, F, and the current passes through the tappets, F, terminals, E, and resistance, H, to the main line wire, and thence on to the distant solenoid, I, at the receiving end, and to the ground. When all of the tappets touch the terminals, all the resistances are in parallel and the total resistance is least and the current greatest; and vice versa, resistance greatest and current least as the number of tappets' contact are broken. By this arrangement of the resistances, there are hills and valleys in the current corresponding to those on the film's surface. This variable current, circulating around the solenoid, I, produces a varying pull on the core attached to the end of the lever, J. This lever is fulcrumed at K. A diamond or V shaped cutter, L, is attached to the lever, beneath which is a plain gelatine or wax film attached to the cylinder, M

With this arrangement in mind, it will readily be seen that with one revolution of the cylinder, A, as the tracer follows the elevations and depressions upon the film, the free end of the lever, C, is made to contact with the ends of one or more of the tappets, permitting more or less of a current to pass through the resistance, and exerting thereby more or less of a downward pull on the end of the lever, J.

We have shown but four of these tappets for simplicity, but it will readily be seen that the greater the number, the more delicate will the variations be of the pull on the core of the solenoid. The number is not limited, but Mr. Amstutz finds not more than ten as being all that would be required, while for the bold work required for newspaper printing, a much less number would be better.

Supposing now that a relief plate or film has been fastened upon the transmitting cylinder, A, and a smooth film of gelatine or wax upon the receiving cylinder, M, and both are revolved at the same speed. One revolution would cause the V tool, L, to cut a line around the film, irregular in its depths and widths, caused by the varying pull on the lever's end by the core of the solenoid. A picture is not made, however, by one line, but one line is, however, an element of a whole picture, so, as the cylinder revolves, the tracer and the V tool are moved along by the screw shown in Figs. 1 and 2, and, spirally, another line is produced by the side of the first one, with varying depths and widths of cut, Fig. 6, corresponding to the neighboring waves of surface on the film. The lines are thus continued over the film from end to end, and when the film on the cylinder is electrotyped it is ready to be printed from.

The two machines which we show in Figs. 1 and 2 have the same general characteristics: A mounting frame, a traveling tracer and graver carriage, guided by the round bar at the back and moved forward over the cylinder by the screw in front of the guiding bar, a rotating cylinder corresponding to the cylinders, A and M, suitable gearing at the ends for revolving the cylinder and screw, the necessary adjusting screws and nuts and a synchronizing device for governing the speed of each cylinder.

With the perfection of detail, which is now the work of Mr. Amstutz, the class of engraving done by this method will be of the highest order of art—line engraving. The work it accomplishes is not confined in its scope to gelatine, but designs may be chased and engraved also upon the metals, as gold and silver ware. Neither is it necessarily a long distance or line operator, for the machines may be placed side by side and local work can be accomplished.

We have selected two examples of the work done by these machines in their present form, which will convey to the intelligent critic a faint idea of the artistic capabilities it can be made to display when its future perfection of detail is accomplished. Both the portrait of the inventor and the view of the boy and dog were engraved upon these machines in the private laboratory of Mr. Amstutz, the time required in engraving the latter being but three minutes.

It is not difficult to believe that in the future events which may take place in London or Paris may be sent from photos taken in Europe, and the reproduction of the same, in an artistic picture, appear in the next morning's New York or Chicago papers; and this without disturbing the existing conditions of telegraphic communication further than supplying the two offices each with machines for transmitting and receiving.

Mr. Amstutz has had practical experience with and is familiar with the general requirements for illustrative work, and is conversant with the limitations of art work as used in book and newspaper printing. In consequence, he has been better enabled to cope with all the difficulties and overcome them in these machines. Improvements, however, are now in progress, principally to give greater expedition, and to render either continuous or alternating currents applicable—the same principle, however, being the foundation.

We are under obligations to Mr. Amstutz for the opportunity to present these, the first sketches ever made from these machines; and courteously permitting us to lay all this interesting subject, in a complete form, before our readers. Mr. Amstutz has signified his willingness to answer such correspondents as may, briefly, desire further information.

The Fender Craze.

The mayors and inhabitants of some of our cities are going daft about fenders for street cars. It is in a way a repetition of the early craze for guard wires. In some places fenders have been made compulsory, in others they soon will be. Now we have nothing to say against the proposition that a fender may save life and limb. Probably the best fenders now on the market may be useful once in a while. But we know that some of the fenders are dangerous delusions and that it is a better principle to avoid knocking a foot passenger down than to chance picking him up alive but in a more or less bruised and mutilated condition. Several cases have been recorded of late in which people struck by fenders have not only been injured but killed.

To us it seems to be altogether the better way to give the cars improved braking facilities. Then the fender can be added, if desirable, but as a general thing these fenders have many elements of undesirability. They obstruct the street more or less. They add to the driver's cares and demand special attention, instead of relieving him of strain and worry. They act after the event instead of before it and instead of preventing it. Cable or electric street cars often make locomotive speed. They are permitted and adopted because they can give the public such speed. If they did not, it would be better to go back to horses. But on a locomotive the cowcatcher does not replace the air brake.

The main, vital, essential thing to-day with all fast-running cars is to give the drivers swift, direct, easy control of the speed of their vehicles, and this is to be done only with brakes that act instantaneously. If there is to be any legislation, let it be of a kind looking to the adoption of good brakes. A car with its running gear all housed around with a light valence close to the ground and furnished with an efficient brake can maintain high speed and will take no life that is not sacrificed to it. Accidents there will always be so long as humanity is weak, careless and erring; but cars equipped as we suggest will be juggernauts only to willful suicides.—Electrical Engineer.

An Unjust Patent Statute.

Such is the designation to statute 4,887 of the patent laws given by Dr. Elihu Thomson in a recent article in the Electrical World. He says:

"While the decision of the Supreme Court makes it plain that the wording of the law in relation to the limitation of United States patents by foreign patents is to be taken instead of what would seem to me to have been the evident intent of the original enactment, I wish to point out some of the injustices under which the American inventor has suffered from this law, as it has been and is now interpreted, in comparison with inventors and workers abroad.

"An American inventor making application for a patent has been and will still remain under the disadvantage of being required to perfect his United States patent before applying for patents abroad, and in order to secure valid patents abroad he must refrain from publication of any new matter which he may have discovered until such foreign patents have been obtained, as the mere publication nullifies the right to take a patent in most important foreign countries. But it is practically impossible, as is well known, under our system of patent examinations, to control the time of issuance of a patent in the United States, and if the application should become involved in an interference, which is more than apt to occur with inventions of any considerable importance, the issuance of a patent may be tied up for an indefinite period of years. During this period there is every prospect of the same subject matter being worked upon abroad, or the matter becoming published, especially if the invention undergoes development in the United States. The inventor, therefore, if he desires foreign patent protection, must take his foreign patents and stand the shortening of the term of the United States patent; or, if the interference proceedings or other delays last during the life of the shortest foreign patent, he receives a patent which has already expired when it issues, a "still born" patent, so to speak.

"Again, in the race between two interfering inventions, the weaker party, finding that he will probably lose the interference in the United States, may easily transfer his scene of activity to foreign countries, while the stronger party, feeling that he does not wish to ruin his United States interest, at the same time refrains from patenting abroad. In this case the party who is likely to come out ahead here does come out at the last without any foreign patents, while the other party to the interference may come out with several valid foreign patents, but no United States patent.

"Now, I do not think it requires any argument to show that the evident intention of the United States law when it was first passed was not to bring about this state of things, and so handicap the honest American inventor. Nor is this all. The position of the foreign inventor under the United States law has been that he could make his applications in foreign countries whenever he felt like doing so and receive his patents, and, after an indefinite period thereafter, he was at liberty to apply for a United States patent and obtain a patent only limited by the shortest term foreign patent. Prior publication here would not affect his rights. Prior publication does affect the United States inventor's rights abroad. Does not this amount to a discrimination against the United States inventor? And would it not really tend, were there not other favorable influences, to discourage invention here?

"The United States is entitled to take its proper place, not only in the actual work accomplished, but in the literature which naturally accompanies the work and without such a restraint as now exists. The question arises, How long is the United States worker to be so handicapped, or practically put under a ban, by ill-considered laws? This is a question which I have often asked myself, and the answer to which, I have no doubt, has been sought by many who have experienced the same hardships."

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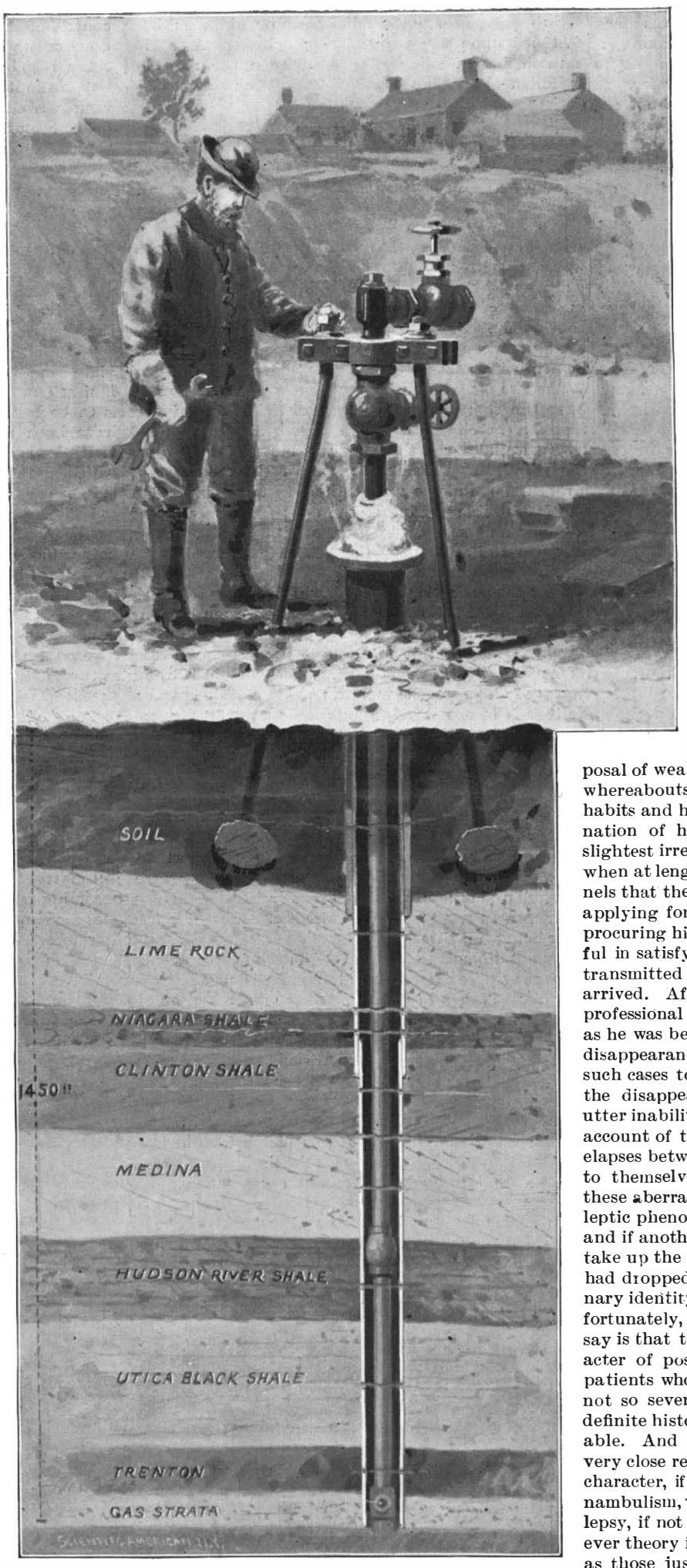
AN OHIO NATURAL GAS WELL.

Our engraving shows the tubing of an Ohio gas well as it appears when just completed. The particular well from which our sketch was made is located in the back yard of a lot on Market Street, in the city of Tiffin, Ohio. The well was sunk by Mr. John Cox, 76 Mill Street, Tiffin, Ohio, and we are indebted to him for the following particulars: The well is 1,480 feet deep, and the gas pressure 400 pounds to the square inch. Through the top layer of earth an 8 inch wrought iron pipe is carried down and bedded a few feet in the first rock formation, which is lime rock. Boring is continued through this formation with a 6 inch hole and is also piped or cased with a 5¾ inch wrought iron pipe down to and through the next formation, which is Niagara shale, to the Clinton rock. This large piping, or casing, is for the purpose of keeping out water from the future gas stratum. The boring is now continued through the Clinton, Hudson River shale, Utica black shale, to the Trenton. The gas strataum is found near the upper crust of the Trenton, and is a stratum of porous rock, similar in structure to a sponge. If the boring is continued into some of these strata, a stratum of oil-bearing sponge is found underneath, and a further boring is very likely to strike a salt water vein. The oil stratum is not universal, the salt water almost invariable.

The strata of gas-yielding material run in a northeast and southwest direction, in veins of varying width, with intervening spaces of only solid rock, in which is no gas. These veins run from a few inches to 15 or 20 feet in width.

We read that "wells are shot." The boring may go close to a stratum and show a slight indication of gas, by percolation into the well. Knowing by the indications that the stratum is near, they lower tin cans or pails, with bails attached, by detachably hooked *ropes, filled with nitroglycerine*, one can on top of another, until they have about 50 to 75 quarts of nitroglycerine down. On the top of the last can lowered is placed an exploding cap, and an iron "go-devil," or piece of iron about 2 feet long, with slight fins on the sides, is then dropped in. The fall of 1,450 feet, the average depth of the wells here, explodes the glycerine, shatters the intervening rock, into the gas stratum. The first rush of gas is terrific in volume and noise. This soon subsides to a pressure that admits of lowering a 2 inch wrought tube to the bottom of the well, but this tube is interrupted in its continuity, at a point varying but about 50 feet from the bottom, by a slip joint and a rubber packing, 18 inches long, confined between two collars, one on the upper and the other on the lower sections of pipe. Gas can escape past the packing as well as through the pipe itself, until a downward pressure on the pipe at the surface, compresses the rubber and closes the hole at that point. The necessary compression is obtained by two side rods (shown in our engraving) attached to "dead men," or two logs, about 18 inches diameter, 10 to 12 feet long, and buried about 6 or 8 feet deep, one on each side of the well, and through which the rods pass, having a head, of course, on the lower side of the rods. The flow of gas is then under control by the globe valves, as shown, and from which the gas is conveyed by the usual pipes.



AN OHIO NATURAL GAS WELL.

Photographing Soap Bubbles.

Lord Rayleigh, in delivering his second lecture at the Royal Institution, on March 9, gave an explanation of some of the methods he had recourse to when endeavoring to become acquainted with what, on account of rapidity of motion, would otherwise elude observation. The most obvious method of observing what was going on when changes were very rapid was, he said, to get an instantaneous picture. For this purpose the degree of "instantaneity" had to be varied considerably. By means of the magnesium flash, produced by blowing powder of magnesium into a flame, a brilliant light of great photographic qualities was generated. Although it occupied about the tenth part of a second, and was instantaneous enough for babies and many other objects, it would not do for all purposes. The electric spark, however, served for almost anything that ever happened, as it could be reduced in duration below one-millionth part of a second, during which time there were not many things which could do much. This method might be turned to excellent account in all kinds of observations. He had used it himself in many cases when he did not know in the least what was going to be revealed. Many complicated phenomena moved so quickly that it was impossible to know what took place, but by the light of the flash one could see what transpired at some particular moment, and that would often give the key to the enigma. He himself had photographed the breaking up of a soap bubble, a process which occupied between the two-hundredth and three-hundredth part of a second.

A STEEL cable one and one-half inches in diameter, traveling twelve miles an hour, can transmit nearly 2,000 orse-power.

Mysterious Disappearances.

A recent article by Dr. Osborne in the Medico-Legal Journal on "People who Drop Out of Sight" appears, says the Lancet, to afford food for thought, not only to the student, but even to the proverbial "man in the street." "The first case mentioned is that of a man, thrifty and industrious, prosperous in his business and exemplary in his family relations, who left his house one Sunday afternoon to have a short walk, being reminded by his wife as he went out not to be late for dinner, which was to be ready in a few minutes. He did not return, no trace of him could be found, and no reason for his disappearance was discovered when his affairs came to be wound up, as they had to be in the course of time. Two years later, in a shop in one of the Southern States of America, a man who had been known as an industrious, although taciturn, workman suddenly seemed to wake up and asked where he was and how he had got there. Gradually things came back to him; he remembered leaving his house in the North on a Sunday afternoon two years before, but everything that happened subsequently was as if it had not been. Nothing of his wanderings could be discovered further than that some months before he had appeared in the town in which he came to himself and had asked for and obtained work, which he had performed diligently and efficiently. He was restored to his family, and at the time the article was written had resumed his former life. Another and even more striking case is related—that of a lawyer, a well-known public man and politician, of more than usual ability and in a prominent social and professional position. One day, while in the midst of some intricate and important legal work, he stepped outside for a few minutes. He also disappeared. The most vigorous and thorough search failed to discover him, dead or alive. Streams and reservoirs were dragged, woods were searched and every means at the disposal of wealth and influence were used to discover his whereabouts. He was known to be abstemious in his habits and happy in his home, and a searching examination of his business affairs failed to reveal the slightest irregularity in them. Several months passed, when at length word came through government channels that the missing man was in Australia and was applying for means of establishing his identity and procuring his transportation home. He was successful in satisfying his friends of his identity, money was transmitted to pay for his passage and in due time he arrived. After a short period of rest he resumed his professional work and has since continued to be just as he was before his sudden and quite unaccountable disappearance. It is an interesting question, How are such cases to be accounted for? The suddenness of the disappearance, the absence of motive and the utter inability of the patients to give even the slightest account of their experiences during the time which elapses between their disappearance and their coming to themselves, all give a certain weird character to these aberrations. Are they of the nature of post-epileptic phenomena? Are they lapses into an alter ego, and if another such lapse occurred would the patient take up the thread of this second existence where he had dropped it to resume his, what we may call, ordinary identity? These are interesting questions. Unfortunately, they are unanswerable. All that we can say is that these disappearances partake of the character of post-epileptic phenomena, and that in some patients who have suffered from lapses similar to, if not so severe as, those just described a more or less definite history of true fits of epilepsy has been obtainable. And another thing is also significant, viz., the very close resemblance that these attacks bear in their character, if not in their duration or severity, to somnambulism, while the relation which this bears to epilepsy, if not very definite, is certainly close. Yet whatever theory is put forward to explain such phenomena as those just referred to, they remain striking and mysterious, interesting in their psychological aspect, but in their concrete form full of practical and medico-legal difficulties."

PLANS have been made for connecting the cities of New York, Philadelphia, Baltimore and Washington by a trolley line. A road to connect Baltimore and Washington is now under way, and the same company has a charter permitting the extension of the road to the Pennsylvania line, where, according to the plans outlined, it will connect with a line to Philadelphia. The line from Jersey City to Newark is already in operation.

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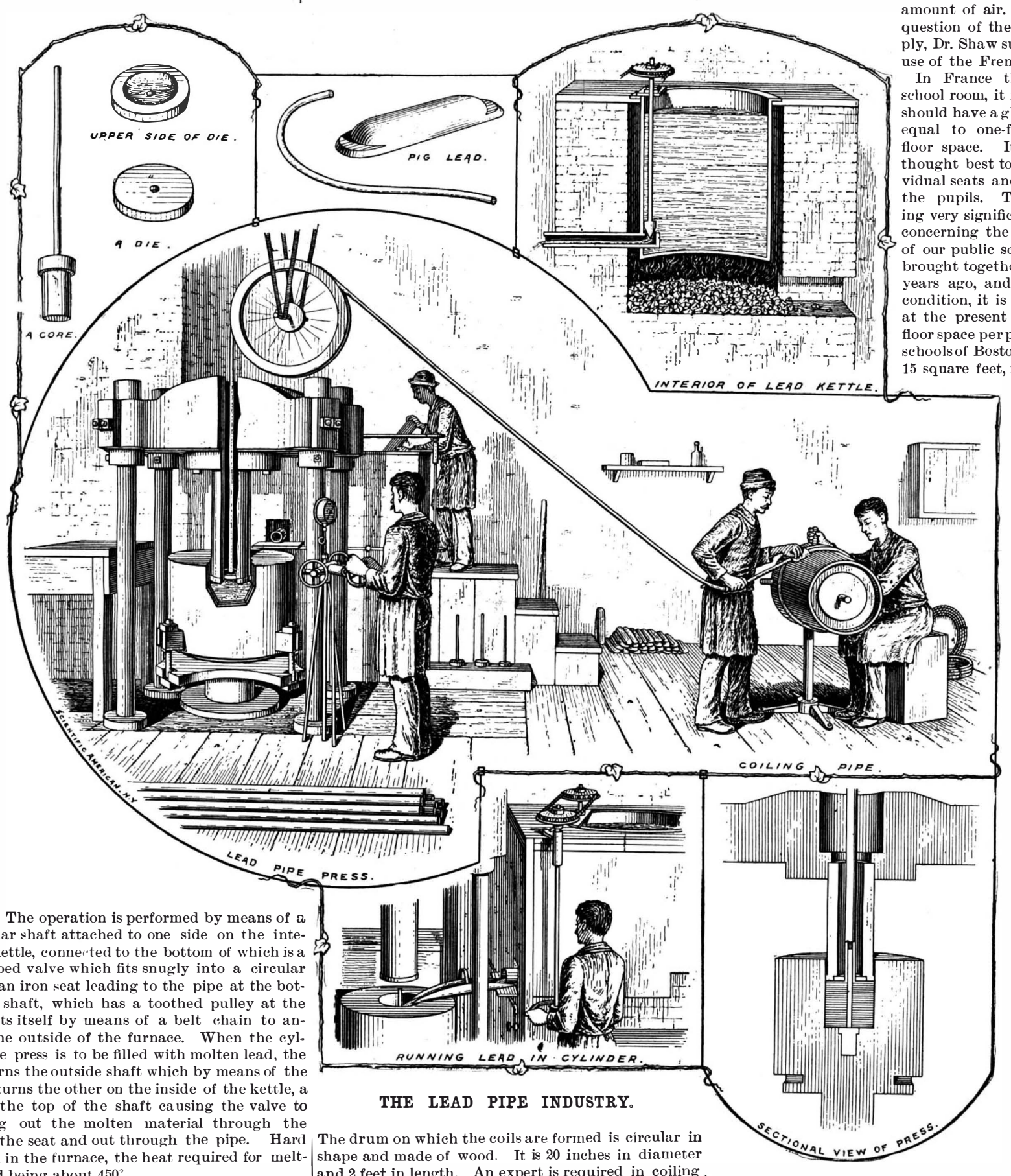
MANUFACTURE OF LEAD PIPE.

The ore from which great quantities of lead pipe is made comes from Colorado and Missouri. The material is first smelted and refined and cast or moulded into pigs weighing from 50 to 100 pounds each. These pigs average about 3 inches in thickness and range in length from 1½ feet to 3 feet. The first operation is the melting of about 40 of these pigs of lead in a kettle incased in a fire brick furnace about 4 feet square. The kettle is made of cast iron about 2 feet 3 inches in diameter, 2 feet 3 inches in depth and about ¾ of an inch in thickness. It is flanged at the top and rests on an iron frame

Connected to the outside near the bottom of the kettle is a 4 inch iron pipe or spout through which the molten lead is passed into the cylinder of hydraulic lead press. The operation is performed by means of a perpendicular shaft attached to one side on the interior of the kettle, connected to the bottom of which is a conical shaped valve which fits snugly into a circular opening in an iron seat leading to the pipe at the bottom. The shaft, which has a toothed pulley at the top, connects itself by means of a belt chain to another on the outside of the furnace. When the cylinder of the press is to be filled with molten lead, the operator turns the outside shaft which by means of the belt chain turns the other on the inside of the kettle, a thread at the top of the shaft causing the valve to rise, letting out the molten material through the opening in the seat and out through the pipe. Hard coal is used in the furnace, the heat required for melting the lead being about 450°.

To keep up the supply of molten material the kettle is charged about every ten minutes with 5 pigs of lead. The cylinder of the hydraulic press is about 2 feet in diameter on the outside, and about 2 feet in height. The diameter of the inside in which the molten lead is run is 8½ inches, and in depth about 17 inches. In the center of the bottom of the cylinder is a socket in which a circular iron core is placed. The cores are about 24 inches in length, and run in diameter from ⅛ inch upward. They are keyed fast in the socket at the bottom and project up above the top of the cylinder about 2 inches. Keyed to the press above is a hollow circular steel ram, in the bottom of which is a circular steel die about 1½ inches in thickness. These dies range from 4½ to 6 inches in diameter. The dies are keyed fast in the ram, each having a circular hole a little larger than the cores passing through the center. The cylinder is first heated by steam and about 350 pounds of molten lead is run into it from the kettle, the operation taking about one-half minute. The cylinder is then started in motion, rising upward with a hydraulic pressure of 5,000 pounds. As the cylinder moves upward, the core and the molten lead which surrounds it is pressed up through the hole in the die. As soon as the lead reaches the upper side of the die, it instantly thickens or chills around the core by means of the air in the hollow ram, which is about 4½ inches in diameter.

From the ram the pipe is forced upward from the core, passing through an opening at the top of the press, where an attendant passes it over a 4 foot wheel above, and down to a drum below, where it is formed into coils. The cylinder is emptied of its contents in about 3 minutes, making about 50 feet of lead pipe.



THE LEAD PIPE INDUSTRY.

The drum on which the coils are formed is circular in shape and made of wood. It is 20 inches in diameter and 2 feet in length. An expert is required in coiling the pipes, it being necessary to know how many rounds of lead are required for each size pipe. The operator presses the lead pipe against his hip with one hand, while with the other, he forms the coil, his attendant at the same time turning the drum, which revolves loosely on a horizontal shaft running through the center. Two 150 pound coils are formed at once, the operation taking about two minutes. The pipe as it leaves the press is also cut up into straight lengths of 10 feet each, the cutting being done by a hand saw. The molten lead enters the cylinder from the kettle at a temperature of about 450°, the pipe when reaching the coiling apparatus still retaining a temperature of about 200°. The lead runs from $\frac{1}{64}$ to ½ inch in thickness, according to the size of the pipe. Six hands on two presses turn out about 25,000 pounds of pipe per day. About 18,000,000 pounds of lead pipe is manufactured in New York City yearly. The sketches were taken from the plant of the New York Smelting and Refining Company, New York City.

Ventilating the School Room.

Dr. Shaw, a prominent pedagogist, in an address delivered recently before the Association for Improving Public Schools, has made some very interesting suggestions concerning the proper arrangement and equipment of school rooms. In the matter of ventilating and lighting, Dr. Shaw believes that an ideal school room should provide fifteen square feet of floor space for each pupil, and a supply of 200 cubic feet per minute for every person in the room. A supply of less than twenty cubic feet he considers very bad ventilation. Such provisions would insure the free movement of every child and a wholesome amount of air. As to the question of the light supply, Dr. Shaw suggests the use of the French system.

In France the perfect school room, it is thought, should have a glass surface equal to one-fourth the floor space. It is also thought best to have individual seats and desks for the pupils. The following very significant figures concerning the conditions of our public schools were brought together some few years ago, and the same condition, it is said, exists at the present day. The floor space per pupil in the schools of Boston averaged 15 square feet, in Chicago 14 square feet, in Washington from 10 to 15 square feet, and in New York from 5 to 9 square feet. In the matter of ventilation the average in the Boston schools was found to be about 185 cubic feet, in Chicago 225 cubic feet, in Washington from 115 to 250 cubic feet, and in New York from 70 to 100 cubic feet. The average school room, especially of New York, it would seem, is insufficiently ventilated and very much overcrowded. There is besides very often a lack of a wholesome quantity of sunlight and an inadequate supply of desks. The fault is a very serious one. It is to be hoped that some trustworthy scientific standards relating to these matters may be adopted and rigidly enforced.

THE postmen of London together walk something like 48,350 miles per day, a distance nearly equal to twice the circumference of the globe.

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Indigo Blue Surface Colored Paper.

The indigo carmine used for the production of indigo blue surfaced colored papers is best obtained from a solution of indigo by precipitation with common salt. The vessel in which the precipitation takes place does not require to be large, there being no effervescence produced by this method of precipitation, as in the older method of precipitating the carmine with soda. The precipitate subsides, moreover, in an hour or so, while a day at least is required when soda is used. The character of the two precipitates is also different; that obtained by common salt having greater covering power than the other. The carmine obtained by precipitation with soda is always pasty, and is apt to produce dark streaks on the surface of the paper.

Indigo carmine is prepared as follows: 2½ parts of indigo are first ground to a fine powder by passing it several times through a grinding mill, and then spread upon a thick sheet of unsized paper in a layer about ⅜ of an inch deep and placed in a warm dry room for three or four days. A strong earthenware jar is then tared on a balance, and if indigo of medium quality is taken, 11¼ parts of fuming sulphuric acid accurately weighed off. It is usually reckoned that 1 part of good Bengal or Java indigo requires 5 parts of fuming acid, but for other kinds from 4 to 4½ parts. The mixing must take place in an open space, so that the vapor evolved can escape. The dry pulverized indigo is added to the acid in small quantities at a time while continually stirring with a glass rod to prevent overheating. When all the dry powder has been added, the vessel is set aside and stirred from time to time. After three or four days the indigo will be dissolved, which can be ascertained by withdrawing the glass rod and examining it for any particles of indigo powder. If small particles are noticed adhering to it, too little sulphuric acid has been originally used, and it is necessary to add a further quantity of ¼ or ½ part, stirring well after the addition and allowing to stand two or three days longer. The dissolved indigo is then slowly poured into 20 parts of cold soft water contained in a wooden cask, stirred gently, and allowed to stand 24 hours. The fluid is then filtered through a linen cloth filter into a second wooden vat provided with a running off tap filled in the bottom. The greenish black residue remaining upon the filter is preserved, and sold for use in the manufacture of felt hats.

The filtered indigo solution is now precipitated. The vat in which this takes place is made of wood and should be of large capacity (40 gallons capacity for 5½ lb. indigo), and is provided with taps in the side for running off the clear liquor, etc. It is placed two feet from the ground upon a wooden frame. The filtered indigo solution is poured into this vessel, and there is then gradually added a solution of common salt, containing 23 parts NaCl dissolved in 40 parts water. The indigo carmine separates out as a very fine precipitate, which remains suspended in the fluid. The whole must therefore be filtered and the precipitate washed. The apparatus for this purpose consists of two boxes resting upon one another, the bottom one being about 4 feet 6 inches long by 2 feet 6 inches wide and 1 foot deep; the upper one is a little smaller, and is placed on cross spars directly over the large one. Small holes are drilled in the bottom of the upper box to allow the liquid to escape. It is then lined with the filtering medium, which consists of a double layer of good unbleached linen, previously steeped in a solution of crystal soda. The filter bag itself, consisting also of linen, is placed in this. It is steeped in soda solution before being used.

A small quantity of the fluid containing the precipitated carmine is first poured upon the filter to fill the pores of the linen filter cloth. The fluid containing a little of the precipitate which first passes through is returned to the bulk of the liquor in the large vessel. After a short time, however, a clear dirty yellowish green liquid passes through alone, which is thrown away, the indigo carmine remaining behind upon the filter. After the whole of the liquor has passed through, the precipitate is washed twice with cold soft water, the first wash water being allowed to pass through before the second is added. The first washings are usually dirty, and are thrown away; but the second are strongly colored, and may be used for a variety of purposes. After the second washing, the indigo carmine is ready. It forms a thick, brown-looking mass, and is removed with a wooden spatula and preserved in boxes for further use. Two and a half parts of indigo yield from 30 to 35 parts of paste.

In this state it is too concentrated for direct use in the manufacture of surface colored papers, and therefore it is dissolved in 80 parts of warm water (60° C.) in a wooden vat by continual stirring for two hours. The carmine should dissolve completely. The deep blue fluid is now tested to ascertain whether it is free from acid, the presence of which causes the color to pass through the paper, coloring it an intensive yellowish green. In all surface colored papers the color should not penetrate the texture of the sheet. Two beaker glasses are half filled with the indigo carmine solution and a glass rod placed in each. Four or five drops of a strong aqueous solution of crystal soda (50 per cent) is then added to one of the glasses and the mixture stirred. If only a trace of acid is present, the fluid becomes much thicker than that in the other glass. When such is the case, 1 part of crystal soda dissolved in 5 parts of hot water is slowly added to the indigo carmine fluid in the large vessel.

Indigo carmine prepared in the above way is excellently adapted for producing blue surface colored papers, either by machine or by hand. Usually the paper receives only one coat on each side; the finest kinds are, however, coated twice, well sized papers free from wood being used. Weight, about 25 lb., d. crown. Six and a half reams of 480 sheets each, 13½ inches by 17 inches, can be covered with 5½ lb. of commercial indigo.—Chem. Tr. Jour.

A MAGNESIUM TORCH.

Amateur photographers, and some professionals, find in the flash light a great accession to their photographic properties, inasmuch as it enables them to produce really creditable work at times and in places which would prove disadvantageous if daylight had to be depended upon.

For such subjects as require instantaneous work, the explosive powders are useful, and perhaps in the majority of cases necessary, but for nine-tenths of the work flash lights of the torch type, using pure magnesium powder, without any explosive, answers perfectly, while it has the advantage of producing a less offensive smoke.

The annexed engraving shows an exceedingly simple and very effective torch for burning pure magnesium powder. It is similar to some found at the stores; it differs mainly in the matter of construction and materials. A vial three inches high, and one inch in diameter, forms the receptacle for the powder. The

A MAGNESIUM TORCH.

neck of the vial is large enough to receive a small rubber or cork stopper (rubber preferred) having two perforations. In one is inserted a tube having its lower end projecting a quarter of an inch below the stopper, this end being contracted so that its aperture is about one thirty-second inch in diameter, or about as large as a good sized pin. This tube is curved over to receive the rubber pipe by which the blast is furnished to the apparatus.

In the other aperture of the stopper is inserted a piece of tubing of about three sixteenths inch internal diameter and a length of three and three-quarters inches. The tubes may be of glass or brass.

A wire spiral bent into a circle and connected at the ends receives a roll of woolen cloth, or better a filling of asbestos fiber, and the end of the wire forming the spiral is bent at right angles, and wrapped around the tube. A quarter inch space is left all around the tube, betweeen the tube and the inner portion of the spiral. The vial is one-quarter or one-half filled with fine, pure magnesium powder, and the fibrous material in the wire spiral is saturated with alcohol. When all the preparations for the exposure have been made, including lighting the alcohol, the operator blows strongly through the rubber tube; the concentrated jet stirs up the powder in the vial thoroughly, and the air escaping through the longer tube carries the powder through the flame, thus producing a spire of flame about two feet high. Several puffs may be made if the subject is one requiring strong illumination.

The principal point to look out for is to make the contracted blowpipe of such capacity relative to the discharge tube as will insure the comparatively slow passage of the powder through the flame. If the blowpipe is too large, the powder will pass through the flame so rapidly as to fail of igniting. In this way a large proportion of the powder may be lost; but with correctly proportioned tubes the combustion is very perfect.

The writer has taken a number of fair sized interiors with this torch. Pure magnesium powder can be used in this apparatus with perfect safety, but explosive powders used in a confined space (such as the vial in this torch) are dangerous. G. M. H.

The Nature of Electricity.

At the last meeting of the Boston Scientific Society, Prof. A. E. Dolbear presented a paper entitled the Nature of Electricity, which the Boston Commonwealth says was a clear and comprehensive statement of the condition of our present knowledge. The subject has interest aside from its great relations practically to our daily lives and convenience, from the fact that, while there have been many theories proposed to account for electrical phenomena, yet to-day there is no one that is generally held, even as a provisional one, among physicists, while some have even abandoned the hope of ever reaching a consistent explanation of the phenomena.

Prof. Dolbear first gave consideration to fundamental notions in physics, speaking of the phenomena and factors thereof, these being matter, ether energy and motion; the properties of ether being that it is continuous, non-molecular, frictionless, elastic and energized. The origin of electricity was next discussed, this being either from friction, chemism or heat for its direct production or induction for its indirect production.

Consideration was next given the ether, which with its properties becomes the medium in which exist gravity, light, magnetism and electricity. The definitions which have been given for electricity were then reviewed, it having been considered a form of energy, a form of motion, energy itself, a form of motion of matter, a form of motion of ether, etc. Edlund defined it as ether itself; Lodge thinks it to be a wave motion in ether; Roland considers it a property of matter; while Trowbridge assigns it place among the great unknowables.

As to its origin, electricity must have some antecedent motion. When the face of the thermopile is heated, we know that vibratory motion is the condition for its appearance; while in the battery, chemical action is the source, and the heat equivalent of this is a measure of the electricity produced. In glass, wax, etc., mechanical friction produces it, and when a conductor is moved in a magnetic field and electricity results, this will stop on the cessation of the motion. In every case the mechanical motion turned into it is the antecedent, and the energy of the engine is represented by the electricity developed.

From motion, then, results energy; and, if it be molecular motion, we call it heat; if ether waves, we call it light; if molecular exchange, we call it chemism. And all electrical action is motion between matter and ether.

As a summary of his arguments, Prof. Dolbear brought forward the following propositions: Energy is an embodiment of motion in some medium and does not exist independently, while the so-called forms of energy are due to the different kinds of motion a body may have. Transformation of energy is a change from one kind of motion to some other kind. Electricity never appears except when some known form of motion of matter is antecedent, and continuity of motion is a logical and experimental necessity; hence electricity must be a condition of things in matter or else a condition of things in ether.

In support of his position, the speaker mentioned quite a number of experiments which illustrate the rotary, spiral character of the motion of the molecules for example, by transmitting a beam of polarized light through an electric field, while the transmission of currents in opposite directions may be shown by means of a ring of rope which, on being twisted while held in both hands, exhibits a twist in both directions, both twists being traceable completely around the ring.

Vesuvius Destroys Derelicts.

The dynamite pneumatic gunboat Vesuvius, of which there is a full page illustration in the SCIENTIFIC AMERICAN of November 3, 1888, returned to the navy yard in March from a cruise in search of dangerous floating wrecks. The Vesuvius succeeded in finding the wreck of the schooner Josie Reeves floating about six miles off shore, between Shinnecock and Fire Island, and it was destroyed with gun cotton, which was lowered into her and exploded by electricity.

The Vesuvius then went to a point off Barnegat and began the destruction of a submerged three-masted schooner, which is lying in fifteen fathoms of water. Her rigging was broken up and her mainmast was shattered but the weather was so rough that the completion of the work was postponed until more favorable weather sets in. It is customary to leave at least ten fathoms of water above each wreck that is destroyed. At this season of the year, Lieutenant Commander Knox says, there are not more than four days out of every ten that are favorable outside for the work of destroying wrecks, as it is so rough that the little boat cannot work alongside without danger.

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THE ALPINE INDICATOR.

The Alpine indicator represented in our engraving is found in Switzerland upon a hill near Aarau. This apparatus is well known to the bathers who have passed a season at Schinznach-les-Bains, for it is a classical objective of excursions. The utility of this indicator is to give the tourist the name of the mountains that he sees in the distance, and the chain of which, uninterrupted upon nearly half the horizon, forms a grand spectacle. The system consists of a semicircular table whose rounded part is turned toward the panorama, and upon which, pivoting around an axis placed in the center of the rectilinear side, there is a rule forming as it were a radius of the circumference in which the table is comprised. Upon this rule, above the pivot, there is a back sight and at the other end, near the circumference, a front sight. Upon the table, and in their respective directions, are inscribed the principal names of the mountains that are seen in the distance.

The spectator who wishes to consult the indicator must place himself on the rectilinear side of the table and face the panorama. With the rule pivoting around the axis, he will aim at the summit whose name he desires to know, as he would do with a gun, in using the breech and muzzle sights. This done, he will find a name upon the table at the side of the sight. It is that of the mountain aimed at.

The reader will readily understand how it has been possible for the maker to establish this indicator. He has oriented the table by means of a compass, and, placing upon it a map of the environs in the same orientation (the place where the indicator is found upon the map coinciding with the sight upon the table), has, by taking aim at the mountains of the horizon, been able to find them upon the map, and, reciprocally, by aiming according to the map, to find the mountain at the horizon. The result of these operations he has noted upon the table. In order to find objects nearer than the horizon, a map of the surroundings is transferred to the table. As the horizon in the present case is at 24 miles, the space between the back sight and the circumference of the table is divided by equally spaced concentric semicircles, having the back sight as their center, and the spacing of which represents a distance of three miles in a bee line. The object, say a belfry or castle, is sighted, and this is found again upon the map upon seeking it at its approximate distance along the rule. We have seen several of these tables in Switzerland, at Lucerne and Zurich, but they had no sights. The contours of the mountains had been simply drawn and the names placed beneath the corresponding points. This is much less practical.

We have seen the apparatus with sights, as at Aarau, installed upon the tower of the cathedral of Lausanne. It had been established for allowing the night watchman to recognize in darkness a village or farm in which a fire had just broken out, so that aid might be sent thereto.

Since the villages have been connected by telephone with the principal city, the indicator has no longer been used.

We have never seen these indicators in France. Perhaps some exist, but there are certainly many places where they might be put. In the environs of Paris, among others, one of these tables would not be out of place, nor would it be upon the terrace of Saint Germain or upon that of Bellevue. The Alps, of course, would not be seen, but it is not the Alps only that is worthy of interest. We believe that it would be interesting for some one who has the advantage of having a view over a wide horizon at home to establish one of these tables.

A compass, one or two official maps, a flat rule, a sheet of bristol board, and a plank are all the materials necessary.—La Nature.

THE ALPINE INDICATOR.

The Brighton Aerial Cableway.

A new cable railway across the valley known as "The Devil's Dyke," five miles northwest of Brighton, England, was opened on October 13, 1894. Telpher lines are now quite largely used for industrial purposes but a passenger line of this kind is a novelty. The steel wire cable is attached to tall steel columns. The length between stations is 1,100 feet and the span between the columns is 650 feet. The lowest point in the valley below the cable is 230 feet. Suspended from the cable are steel "anchors" supporting, 2 feet apart, two parallel wire ropes, on which the pulleys of the passenger car run. The car is drawn across by a 4½ horse power Crossley oil engine. Each car holds eight persons, and two and one-half minutes are occupied in the trip.

FIRE EATERS.

The fire eaters of whom we propose to speak, and who have been exhibiting in the hall of the Olympia, at Paris, excel in their line anything of the kind that has been seen up to the present. They not only swallow flames, but handle fire and cause it to flash from their fingers.

These fire eaters are two young Americans who have cultivated physics and electricity considerably. When they perform their experiments they are clad in a tight-fitting costume of a red color which represents that of the devils of fairy scenes. The stage upon which they appear remains but dimly lighted during the entire time of their presence thereon. At the back of it there is a piece of furniture that resembles an office desk seen from the rear, but no detail of this object is distinguishable. The devils go behind it and seem to make some preparation with their hands there, and then they come to the front of the stage and cause very thin but brilliant flames to dart from their fingers. Bringing these flames near their mouths, they seem to swallow them, and then extinguish them between their teeth.

When the two devils touch each other's hands, a crackling is heard and long flames dart forth for a few seconds from the tips of their fingers, which they continuously move.

In a subsequent experiment, without putting anything in their mouths, they blow with energy and a brilliant flame makes its exit from between their lips. They shoot forth a jet of flame for a considerable length of time, which certainly exceeds half a minute.

While these singular phenomena are occurring, the spectators absolutely smell no odor. It is probable that the combustion is due to a very volatile essence, but we are unable either to state precisely the nature of it or to give an exact explanation of the experiments performed. The red devils keep their secret, and when they are questioned remain mute.

Our readers, however, may inform themselves as to many points of these curious phenomena by reading two articles entitled "Incombustible Men" that Mr. Guyot Daubes contributed to this journal in 1886. The author speaks of jugglers who lick red hot iron rods and of eaters of lighted tow, and describes the experiments performed in 1881 by a person named Kortig, who had prepared an essence that was so volatile that he poured some of it into his hand and lighted it without burning himself. Mr. Kortig held a seance at a soiree given at the Conservatoire des Arts et Metiers by Mr. Herve Mangon, then director.

We were invited to this soiree and saw the operator light the liquid that he had poured into the brim of his felt hat or into the folds of a lady's handkerchief without the objects serving as a support to the liquid being in any wise damaged.

For the chemist, there are here some interesting experiments to take up and study.—La Nature.

FIRE EATERS AT THE OLYMPIA THEATER, PARIS.

Exhibition of the National Sculpture Society.

The second annual exhibition of the National Sculpture Society will be held, beginning Tuesday, May 7, and continuing until May 23, in the galleries of the American Fine Art Society's building, No. 215 West 57th Street, New York. The exhibition will comprise several novel features and promises to be unusually interesting and profitable. An important feature will be a retrospective exhibition of sculpture, to which all are invited to contribute. All work of sculpture, whether exhibited before or not, will be eligible, subject to the decision of a jury of inspection.

A novel feature will be an exhibition of landscape gardening, arranged with flowers and plants after the designs of Nathan F. Barret, landscape engineer, and Thomas Hastings, architect. It is intended to show something of the possibilities of combining sculpture with flowers and plants in gardening and in interior decoration. The society will also hold in connection with the exhibition a competition for a new design for the United States silver dollar, and the plaster models presented in competition will be on view.

Two prizes of $300 and $200 are offered for the two best designs, and if any design of sufficient merit be presented, the society will urge that it be adopted by the national government. Further information may be had by application to the society.

A DIAMOND weighing not less than 971¾ carats, and said to be the largest in the world, has been found in the Jagersfontein mines, Cape Colony, by Inspector Edward Jorgansen. It was taken, well guarded, to the Cape of Good Hope and put aboard a warship for London and deposited in the Bank of England.

ONE of the most remarkable sights to be seen in Australia is a burning mountain 1,820 feet in height. The mountain is supposed to be underlaid with an inexhaustible coal seam, which in some way became ignited. It was burning long before the advent of white men to that part of the country.

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Liquefaction of Gases.

At a meeting of the Astronomical and Physical Society of Toronto, Mr. Arthur Harvey, who had been requested to prepare a resume of the recent work of Professor Dewar in connection with the above subject, read the following notes:

The method adopted is to lower boiling points by exhaustion. You know the principle. It comes to our notice practically in mining at or above the summer snow line in the mountains. There are several camps in America so high that boiling water will not cook potatoes or other vegetables so as to make them palatable. Carbonic acid, which boils under ordinary atmospheric pressure at —112 degrees, will, in a vacuum such as the air pump can be made to give, boil at —166 degrees. At this temperature nitrous-oxide liquefies, and, itself boiled in vacuo, lowers the temperature and liquefies ethylene, which in turn runs down the thermometer to —229 degrees. At this point pressure is resorted to, and the pressure of 1,500 lb. to the inch (100 atmospheres) forces oxygen into a liquid state. The evaporation of liquid oxygen, also in vacuo, liquefies, under pressure, air and nitrogen, while these again, worked upon in double receivers by powerful air pumps, will produce solid nitrogen. This was first shown in January of the year 1894. Liquid oxygen is 900 times less in volume than the gas at ordinary temperatures—blue in color, because it stops many red, yellow and orange rays. That is apparently why the sky is blue. Like the gas, it is magnetic, springs from a cup of rock salt to the poles of an electro-magnet when the circuit is turned on, and stays there pending its rapid evaporation. Nitrogen seems to be an inert body, with no striking qualities, good to be a diluter or absorbent of the more energetic oxygen. Hydrogen remains now the only body unsubdued by cold and pressure, so a hydrogen thermometer is used to indicate these extremely low temperatures. If hydrogen be, as Faraday thought, a metal, water is a metallic oxide, and it is remarkable how easily this oxide liquefies, while oxygen only becomes fluid under the severest compulsion, and hydrogen resists it with success.

Gases contract $\frac{1}{460}$ for each degree of temperature. What is to happen when a temperature of —460 degrees is reached? At present it seems below the limit of possibility. All gases will liquefy and solidify before this is obtained; so the method of successive reductions above described must fail to achieve such a minimum. But if this absolute zero is reached, will matter vanish through the total deprivation of heat? Heat is the life of matter; the more heat, the more energetic the molecules. Metals become stiffer and tougher under cold—remarkably so at Professor Dewar's low temperatures—become better conductors of electrical currents; but chemical affinity is diminished, so that alloys do not behave in the same way as pure metals, while carbon and some other substances act quite differently. We know from the everyday experience of the incandescent electric light that heat increases the conductivity of carbon, while it reduces that of metals—a corollary of which property of the latter it seems to be that iron at 1,400 degrees is not magnetic at all; nickel at 340 degrees is also inert to the strongest magnets. If the sun is a magnetic center at all, it is not because of its iron or other metals, and this consideration leads me to doubt if the aurora has any connection with the spots on the sun, either as they pass the center or appear on his eastern limb, or with their maximum or minimum frequency.

What is the cold of space? We approximate to it in these experiments. Is it permissible to think that this cold—even without pressure—would liquefy and solidify gases and so facilitate the condensation of dispersed matter into suns and planets, and forbid the existence of a gas in space which would retard the motions of these orbs? Will cold, rather than gravity, thus fix a limit to the atmospheres, permitting no gas to exist outside the calorific influence of the bodies which are still hot from condensation? Has the air there was upon the moon settled down to be a transparent sheet of ice over her surface, fixing her features in an almost eternal setting as hard as adamant?

One more singular point. Molecular convection of heat ceases as the molecules die of cold, but energy still passes through the frozen mass. A burning glass which concentrates heat and light can be made with a spherical vessel full of liquid oxygen. Radiant or ethereal heat and light encounter no resistance on account of extreme cold, when molecular heat can scarcely creep from particle to particle.

Cold affects colors. Sulphur (at —314 degrees) turns white, vermilion fades to orange, iodine in alcohol loses its violet, my authority states, but as alcohol freezes at —202 degrees, the phenomenon must be seen in the solid.

Is the earth homogeneous? When it was intensely hot, too hot to hold any but elementary forms of matter, a time came when it was cooled as to its gaseous envelope, and oxygen, if not hydrogen, combined with its materials to a certain depth. The outer shell thus is alone composed of oxides or rusts, for such we may call all the rocks and other substances that contain oxygen. A time may come when the aqueous vapor and carbonic acid of the air will come down as snow, just as oxygen and hydrogen at a given stage form water, just as carbonic acid and calcium have formed the limestones—and, after that, the interstellar cold will be free to act, and the residual oxygen and nitrogen will form an ice case of eleven or twelve yards in thickness. When, in due course, something like this happens even to the sun, and absolute zero is reached, will matter be loosened from its affinities and disperse? If so, there must be fewer dark stars than Sir Robert Ball thinks possible.

Lodgings for Seamen on Ship Board.

With a view to the promotion of the health of seamen and their protection against the cupidity of owners, a new law was passed at the last session of Congress, the text of which we give below. It will be seen that the cabins must be large enough to give every man a deck space of 12 superficial feet and a total of 72 cubic feet. This is equal to a space of 2 feet wide, 6 feet long, and 6 feet high.

The act was approved March 2, 1895, and is entitled "An act to provide for deductions from the gross tonnage of vessels of the United States." The act will take effect April 1, 1895.

"Every place appropriated to the crew of the vessel shall have a space of not less than 72 cubic feet and 12 superficial feet, measured on the deck or floor of that place, for each seaman or apprentice lodged therein. Such place shall be securely constructed, properly lighted, drained, and ventilated, properly protected from weather and sea, and as far as practicable properly shut off and protected from the effluvium of cargo or bilge water; and failure to comply with this provision shall subject the owner to a penalty of $500. Every place so occupied shall be kept free from goods or stores of any kind not being the personal property of the crew in use during the voyage; and if any such place is not so kept free, the master shall forfeit and pay to each seaman or apprentice lodged in that place the sum of 50 cents a day for each day during which any goods or stores as aforesaid are kept or stored in the place after complaint has been made to him by any two or more of the seamen so lodged. No deduction from tonnage as aforesaid shall be made unless there is permanently cut in a beam and over the doorway of every such place the number of men it is allowed to accommodate with these words, 'Certified to accommodate . . . seamen.'

"That the provisions of this act apply only to vessels the construction of which shall be begun after June 30, 1895."

RECENTLY PATENTED INVENTIONS.

Engineering.

CONSTRUCTION OF VESSELS.—Marie V. T. Dubreuil, New York City. A means of forming two keels in a vessel's hull has been devised by this inventor, whereby the hull will be made stiff both longitudinally and transversely without appreciably increasing its tonnage. The vessel's sides are parallel from the stern to a little beyond the center, and thence tapered to the bowline, the bottom being tapered upwardly toward the bow for a corresponding distance. The hull comprises an outer covering and a skeleton frame of X braces, the hull bottom following the inverted V shape of the lower members of the braces, and thus forming two keels, giving a stability not attainable in ordinary methods of construction.

THE PROPULSION OF VESSELS BY MEANS OF EXPLOSIVES forms the subject of a further patent by the same inventor, the construction of the vessel being similar, but a cannon-like conductor being located at the stern, and extending from within the hull to its exterior. A rotating receiver has chambers for the explosive material, to register successively with the bore of the conductor, a trip mechanism carried by the receiver actuating the hammer to effect the explosions, which may be made to occur at very frequent intervals, as may be needed to cause the constant forward propulsion of the vessel, and without jar to the vessel itself.

A RUDDER specially designed for the form of vessel above described has also been patented by the same inventor, a rudder being pivoted to the bottom of the vessel at the bow, centrally between the keels, while a fin rudder is located at each side of the hull near the stern, the three rudders being easily operated to steer the vessel much more quickly than would be possible with a single rudder at the stern, the vessel being designed to turn almost on its center.

REGENERATIVE FURNACE VALVE GEAR.—John Kernan and Robert B. Yuille, Pittsburg, Pa. This is a simple and durable gear, easily reversed, to connect and disconnect the gas supply and the furnace and the latter and the chimney flue. Diagonal valve seats are formed in a casing, which may be water-jacketed or lined with fire brick, and which is formed with an open top and bottom and side openings, slide valves sliding on the seats so that when one moves inward the other moves outward, while a plug is held in position in one side of the casing by a weighted lever. The valves can be readily repaired while in an outermost position without stopping or interfering with the work of the furnace.

ANGLE COCK.—William J. Waldron, Fort Worth, Texas. This is a device to be applied only on a manually operated angle cock, by means of supplemental fluid pressure pipes, so that the plug cannot be turned by unauthorized persons and without the knowledge of the engineer in charge of the train. It is a device for locking the train pipe valve or plug, by means of a connection separate from the train pipe and under the control of the engineer.

Railway Appliances.

CAR COUPLING.—Thomas Gaskins, Arcadia, Fla. Two patents have been granted this inventor for improvements in couplings of the Janney type, in which the drawhead has at one side a knuckle to couple with a similar knuckle on the other drawhead, there being means of locking the knuckles rigidly in coupled position or turning them outwardly to be disengaged from each other. The first invention consists chiefly in an improved construction and arrangement of the locking lever which holds the coupling knuckle, whereby the draught strain on the pin is so reduced as to permit it to be operated by hand, even when the draught strain is on, the whole coupling being very cheap, simple, and effective. According to the other patent, means are provided for so locking the knuckles that they may be freely and easily disengaged while the draught strain is on, and there is no necessity for slacking or backing the train to uncouple.

CAR COUPLING.—Charles H. Smith, Birmingham, Ala. This inventor has also devised an improvement in couplings of the Janney type, adapting the coupling for an automatic release of the coupling jaw if the securing devices that retain the coupling drawhead in connection with the cars should accidentally be broken or become loosened, the release preventing the coupling from falling on the track, to occasion the possible derailment of a car in the rear. The improvement is simple, costs but little, and all the parts are substantial and not liable to be deranged by ordinary wear.

NUT LOCK.—Henry Hagon, West Superior, Wis. This is an improvement primarily designed as a simple and effective means of joining the ends of rails and holding the several parts from loosening under the jarring and vibrations incident to train travel, the fish plates being secured to the rails and effectively braced by grip flanges or members, so that they will always be held tightly up against the under face of the rail tread.

NUT LOCK.—Henry B. Eareckson, New York City. This improvement consists essentially of an arm pivoted on the nut and adapted to swing into recesses on the outer end of the bolt and in the nut. While especially designed as a lock on railroad rails, joints, and vehicle axles, it is also applicable to a wide range of other uses, being of simple and durable construction and positively locking the nut in place when screwed up.

Mechanical.

HEEL NAILING MACHINE.—John F. Hines, New York City. This inventor provides an automatically-acting and effective mechanism for bending the rand into the requisite shape and inserting it between the sole and the heel plate. The rand-bending device consists of a series of clips having an articulated connection with one another, a slide having a guided movement to bend the clips, as they hold the rand, around the heel-supporting plate. Spring-pressed followers, arranged between the clips and having a sliding connection therewith, engage the outer edge of the rand and force it inward from between the clip members, a cutter severing the ends of the rands, should they project in front of the heel-supporting plate.

WRENCH.—Alf L. Winge, Miles City, Montana. This inventor has patented an improvement in that class of wrenches which have a sliding jaw adjustable by means of a movable rack, to retain the jaw locked at different points on the lever bar, with means for holding the rack stationary. The improvement presents novel details of construction, affording increased efficiency without adding to the cost of the implement.

Miscellaneous.

WALL PAPER MANUFACTURE.—Paul Groeber, Rutherford, N. J. This invention provides a method of and machine for manufacturing paper having an embossed face with a water color effect. The paper is composed of two firmly united layers of pulp, one sized and the other unsized, to form an absorbent face to receive successive colors and a final embossing impression, the sized pulp sustaining the facing during the processes of printing and embossing. By this means water colors may be employed alone or in connection with the regular pigments, some of the rollers also applying gold, mica, flock, flitters, or other illuminating material, oil, distemper, or varnish pigments.

ROLLER CHUTE.—Edwin W. Fuller, No. 304 Guerrero Street, San Francisco, Cal. This is an improved and extremely simple construction for use on grades to convey sugar cane, lumber, firewood, and other materials. It consists of a series of sections pivotally connected at their adjacent ends to have a limited lateral movement, and each section having in its bottom and side walls transverse openings where rollers are journaled in plates, the plates being removably bolted to the outer faces of the sides of the chute, so that any single roller may be removed without disturbing the others. The chute is inexpensive and easily erected, may be adjusted to varying curves, is very strong, and the material thrown into it will be carried forward and downward by gravity and with but little friction.

FOLDER AND PUNCHER.—Frederick C. Mehnert, Goshen, Ind. In devices for folding blank book sections and punching holes in them, preparatory to binding, this inventor has produced a very simple machine adapted to simultaneously fold the sections and punch the holes, doing the work very rapidly and making the holes all alike. The table has in its top, parallel jaws adjustable toward and from each other to vary the width of the slot, which is entered by a vertically reciprocating folder blade having a lower non-cutting edge with projecting needles or perforating spurs to perforate the paper in the fold for the binding thread without cutting the sheets in two.

CARPET STRETCHER AND JACK.—Hosmer F. Jackson, Tyrone, Pa. This is a simple and inexpensive combination household tool, which may be used as a jack for lifting stoves and other heavy articles, or as a carpet stretcher, a removable crank arm of the tool being also adapted to serve as a tack hammer and claw. The implement is readily manipulated by any one capable of handling even the simplest tool.

DRAPERY FORM.—William H. Knapp, Brooklyn, N. Y. A form readily adjustable to a desired waist or hip measurement, and held in such position, has been patented by this inventor, the form resting upon the floor or other support throughout its entire circumference, thus dispensing with the ordinary base. The form may be worked upon without danger of toppling it over or shifting its position, and may be quickly folded up around a central standard.

BUCKLE.—Solomon Z. Quinn, New York City. Suspender buckles constitute the feature of this improvement, the buckle designed by the inventor securely fastening into the web, while it may also be conveniently unlocked to be shifted on the web to shorten or lengthen the suspender. The frame of the buckle has a crossbar extending over the web at the front, while a clamping toothed bar engages the web at the back, opposite the cross bar, the toothed bar being carried by an auxiliary frame hinged on the main frame and adapted to be locked thereto. The buckle is simple, and may be cheaply made.

CRUMB REMOVER.—James B. O. Shevill, New York City. This is a simple device for table use, having a revoluble brush arranged in front of a crumb-receiving pocket. The brush and its operating gearing are inclosed in a longitudinally slotted casing, to the top of which is pivoted a handle, the oscillation of which is limited by stops. The device is moved over the table in the same manner as a hand brush, and when lifted and taken away the crumbs held in the pocket are not liable to drop out.

THILL TUG.—William H. Cable, Staunton, Va. This is a simple, cheap and automatically locking tug, adapted to snugly embrace the thill, and readily operated to release the thill when desired. The tug holding devices are so arranged that the usual draught braces are dispensed with and the pulling and backing are effected entirely by the tug. The tug proper has a hinged member arranged to be swung up around the shaft, and be detachably connected with the other section, to which the harness is attached, and the releasing devices may be operated from the vehicle to almost instantly unloose the animal in case of a runaway.

LUBRICATOR FOR VEHICLE AXLES. Henry B. Eareckson, New York City. A nut is adapted to be secured on the threaded end of the axle spindle, according to this invention, and the nut has in its top an

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oil chamber with an opening leading to the upper end of the feed groove on the spindle. As the chamber is an integral part of the nut, it is always in the proper position, and there is no danger of wasting the lubricant, the spindle being thus oiled without requiring the removal of the wheel.

OVERDRAW CHECK BIT.—Joseph Carter, Blyth, Canada. This bit is independent of the driving bit, and is designed to stay in any position in which it may be placed, not moving up or down in the horse's mouth when the horse is checked. It has a central raised section which may be covered by a cushion, and the ends are slightly curved upward and terminate in eyes, cheek bars connected with the ends of the bit receiving near their connection the check rein, while a nose band is adjustably connected with the cheek bars, there being means for locking the nose strap in a given position.

SLEIGH BRAKE.—Adelbert Mecham, Edinburg, North Dakota. Should the team stop when the sleigh is being drawn up a hill, this brake acts automatically to prevent the sleigh from running backward, and when descending a hill, the action of the team in holding back operates to apply the brake, and thus control the descent of the sleigh. By means of locking devices the brakes are made inoperative when the sleigh is to be backed. The device is inexpensive and is applicable to any form of sleigh.

POLICE NIPPERS.—Leon Brown, Chicago, Ill. This is an improvement in chain nippers, whereby they are so made as to require but a single handle, the loose end of the chain being readily thrown over to an engagement with the handle, forming a loop, which may be contracted upon the wrist of the prisoner by the manipulation of the handle.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN

BUILDING EDITION.

MARCH, 1895.—(No. 113.)

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1. Elegant plate in colors showing a cottage at Mount Vernon, N. Y., three perspective elevations and floor plans. Mr. H. R. Rapelye, architect, Mount Vernon, N. Y. An attractive design.
2. "The Gables," a half timbered cottage recently completed at Glen Ridge, N. J. Perspective elevation and floor plan. Mr. Charles E. Miller, architect, New York City.
3. A cottage at Great Diamond Island, Me., recently erected for H. M. Bailey, Esq., two perspective elevations and floor plans. A unique design for an island cottage. Mr. Jno. C. Stevens, architect, Portland, Me.
4. A dwelling at Armour Villa Park, N. Y., recently erected for J. E. Kent, Esq., at a cost of $5,200 complete, two perspective elevations and floor plans. A very picturesque design.
5. A colonial cottage at New Rochelle, N. Y., recently erected for C. W. Howland, Esq., two perspective elevations and floor plans. Mr. G. K. Thompson, architect, New York City A unique example of a modern dwelling.
6. The residence of Charles N. Marvin, Esq., at Montclair, N. J. A design successfully treated in the Flemish style. Two perspective elevations and floor plans. Mr. A. V. Porter, architect, Brooklyn, N. Y.
7. A fine Colonial house at Elizabeth, N. J., recently completed for Henry A. Haines, Esq. Perspective elevation and floor plans. Architects, Messrs. Child & De Goll, New York City.
8. A residence at Flatbush, L. I., recently erected for C. H Wheeler, Esq., at a cost of $11,000 complete. Two perspective elevations and floor plans. Architect, Mr. J. G. Richardson, Flatbush, L. I. An attractive design.
9. A cottage at Plainfield, N. J., erected for Chas. H. Lyman, Esq., at a cost of $5,000 complete. Two persective elevations and floor plans. Architect, Mr. W. H. Clum, Plainfield, N. J. A picturesque design.
10. An elegant house at Scranton, Pa., erected at a cost of $15,000 complete. Two perspective elevations and floor plans. Architect, Mr. E. G. W. Dietrich, New York City.
11. Engraving showing the new building of "The Bank for Savings," recently erected on 22d Street, New York City. Mr. C. L. W. Eidlitz, architect, New York City.
12. Foundation piers of the American Surety Company's building, New York City. Four illustrations, showing the most advanced methods of caisson construction for city buildings.
13. Miscellaneous contents.—An automatic gas saving governor, illustrated.—Heating a residence with open grates, illustrated.—Arranging effective interior, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

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References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Minerals sent for examination should be distinctly marked or labeled.

(6464) W. C. E. writes: In a town in this State the water supply is pumped from a lake to a reservoir situated at a distance of about 1,800 feet from the pump house, and at an elevation of about 300 feet above the town; the power used to elevate the water is two Worthington compound pumping engines, with steam cylinders 12 and 18½ inches diameter respectively, water cylinders 8½ inches in diameter, all 10 inches stroke, and are of 750,000 gallons capacity each per 24 hours. As the capacity of the pumps greatly exceeds the wants of the village at present, it is proposed to use a portion of the water from the reservoir to operate a 6 inch turbine water wheel, which it is claimed will develop 100 horse power under 300 feet head, to operate a dynamo with which to light the streets. Would this be practicable? Would it cost more or less for fuel to furnish the power for a dynamo in this manner than by an engine directly attached? A. Your pump has a capacity of 520 gallons per minute, and 100 horse power by the best impact wheel requires 1,560 gallons per minute under 300 feet head. So that the total horse power of your pumps is but one-third of the power required. It is a decided waste to pump water by steam for generating water power. Direct steam power for the dynamo is proper and practicable, and the best of all is a combined compound engine and multipolar dynamo.

(6465) J. W. H. asks: What is the loss in friction between the transmission of 100 horse power with direct connections with engine and a bevel gear? Also loss in friction between a direct connected engine and a machine driven by belt? A. The loss of power transmitted by belting is somewhat variable, depending upon thickness, tightness and velocity. On an average the loss is about two per cent by creepage, and the loss by increased journal pressure and flexure of the belt is from ½ to 1 per cent more. A total of 3½ per cent variable. The loss by gearing of equal size and of the larger dimensions, well made and adjusted, is very small, embracing only the friction of the teeth, amounting to from ½ to 1 per cent of the transmitted power.

(6466) G. W. S. writes: I am a reader of the SCIENTIFIC AMERICAN, and would like to know whether in the manufactnre of a small experimental dynamo one would get as good results from a drum armature as a shuttle armature? And if so, ought the size and amount of wire on the armature be the same as would be used in the same dynamo on a shuttle armature? By all means use a drum armature. Make it larger; two or three times the diameter of the shuttle armature. We refer you to SUPPLEMENT, Nos. 161, 599, 600 and 844, for information on the construction of small dynamos; price 10 cents each by mail.

(6467) E. W. H. writes: 1. Kindly tell me how walls are wainscoted with tiles, that is, how the tiles are best fastened to the walls, and what backing is first laid down upon which to lay a tile floor over wooden joist, so as to insure a water tight job free from cracks. A. Portland cement freshly mixed is the best bedding for tiles for walls and floors. For floor backing put in a deafening floor two inches below the top of the beams, well fastened to prevent springing, and fill with good mortar concrete even with top of beams, and on this surface bed the tiles with Portland cement. 2. What thickness of plate glass would you specify for a residence, size of glass 3×3 feet, and how thick should the frames be for such glass? A. If polished plate is to be used, it should be ¼ inch thick. For common plate ⅛ inch or $\frac{3}{32}$ inch is the usual thickness. Frames for the ¼ inch glass should be 1⅞ inch thick, for the thinner glass 1½ inch thick. 3. Would Portland cement be preferable as a mortar to lay brick in a foundation wall, to lime mortar tempered with cement? If so, please give proportions of sand and Portland cement best adapted, and say if such mortar would be unfavorably affected by the heat if it were used in laying chimney brick. A. Portland cement is best for foundation walls in varying proportion with lime according to economy desired. Lime 3 parts, Portland cement 1 part by measure makes a strong mortar with 8 to 10 parts sharp sand. This also makes a good mortar for ordinary house chimneys. 4. What proportions of Portland cement and sand would be best adapted for plastering the inside of a brick cellar wall to make it water tight? A. Equal parts of Portland and clean sand for cellar wall plaster. 5. Is there any objection to the use of sheet lead for gutters, flashings, and flats, and how should the edges of the sheets be soldered together? A. There is no objection to the use of sheet lead for flashings. The edges should be turned up, cleaned by scraping and burned together with a hot iron without solder.

(6468) H. S. L. A. asks: What is the latest theory of electricity? We have several theories of our own make, and would like to know how far we are from the most generally accepted theory of electricity. A. Your question is a very broad one. You will find excellent articles on the subject in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 666, 719, 857, and 995. We can also supply any books on the subject.

(6469) L. B. asks: 1. In what way does the difference in distance between the carbon and platinum points in the Blake transmitter affect the intensity of the current? Does the current decrease according to the amount of air between the points of contact? A. The points are always in contact. The pressure constantly changing causes the variations in current effecting the transmission of sound. 2. If a thin rubber ball filled with carbonic acid gas were placed near to the mouth piece of a bell receiver while in operation, would the sound be increased? Could this sound be retransmitted? A. It would concentrate, not increase the sound. It could be retransmitted. 3. Do you think that it would be in any way possible to obtain power from the rotating of the earth? Has any one ever attempted it? A. This is among the possibilities, but has not yet been demonstrated to be practicable. 4. Have made Page's rotating armature as described in Sloane's "Electrical Toy Making," and it works well as a motor but it will not generate. Cannot surmise what the cause is. If possible suggest a remedy. A. It will generate some current if rotated rapidly enough. 5. Please refer me to some periodical or book telling of the advantages of galvano-cautery. A. For a good treatise or galvano-cautery we refer you to Bigelow's "International System of Electro-Therapeutics," 8vo, cloth, 1160 pages. Price $6 by mail post paid.

(6470) J. D. says: 1. I have constructed storage battery like one described by you some time ago. What would be proper resistance to discharge them through in forming; size of plates 10×12, 7 plates to cell, 26 cells in all? What would be number of hours they would run, and how many 16 candle power lamps would they run, and how long? A. Four ohms resistance will answer for discharging in series. They should run ten hours and maintain about twenty 16 candle power lamps, but it would be safer to make a large deduction to allow for imperfection of construction. 2. Have motor sixteen segments to commutator, leads give one-quarter turn, brushes work on opposite sides, have three ¼ inch carbons in each brush holder, and in a few minutes' run, commutator and brush holders become so hot that you cannot touch them, and in a short while so hot that it will unsolder leads from commntator. Run with 50 volts about 10 or 12 amperes. Please give me cause for this, and remedy. A. Your field may be out of proportion to your armature, but try giving it less potential. Interpose a resistance in series with it.

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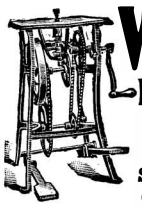

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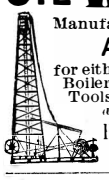

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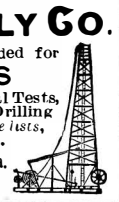

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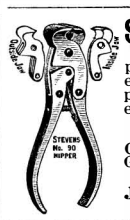

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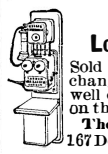

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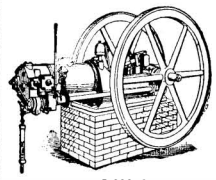

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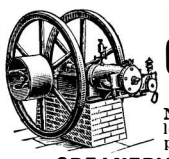

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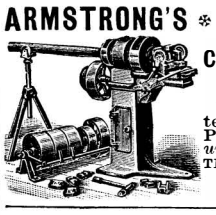

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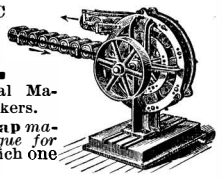

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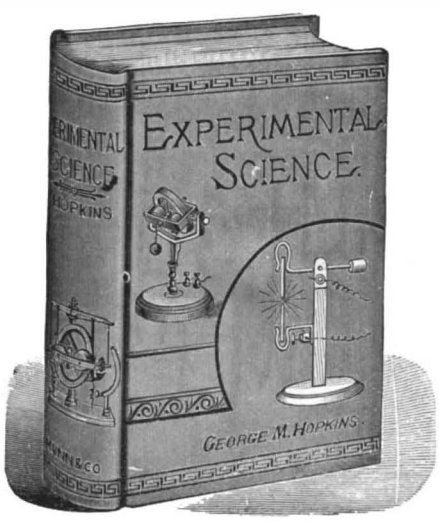

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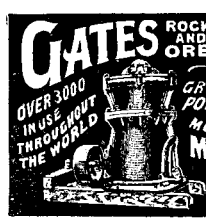

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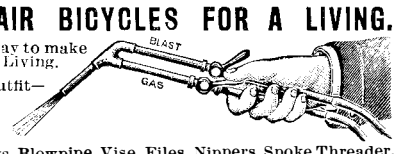

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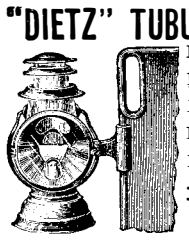

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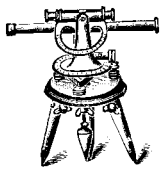

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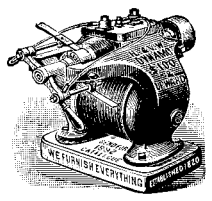

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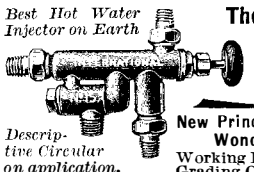

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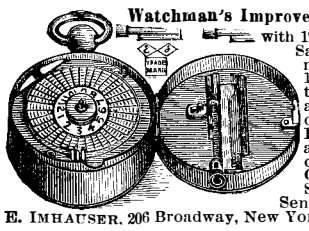

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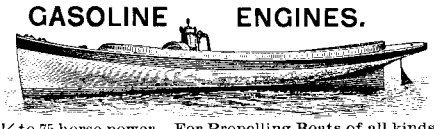

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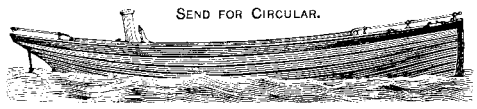

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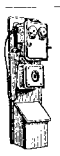

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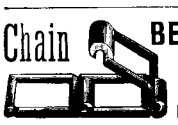

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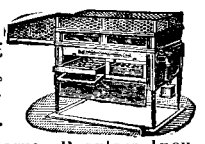

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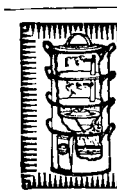

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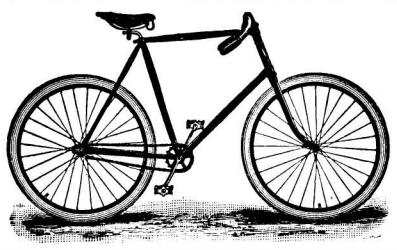

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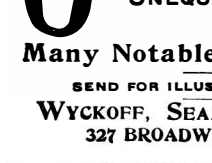

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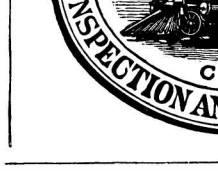

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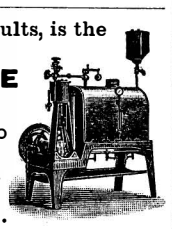

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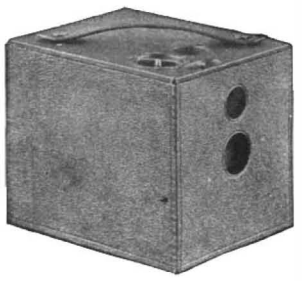

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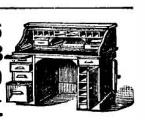

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